Draft Environmental Impact Statement

# FERAL SWINE DAMAGE MANAGEMENT: A NATIONAL APPROACH

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| Lead Agency: | U.S. Department of Agriculture<br>Animal and Plant Health Inspection Service |
| Cooperating Agencies: | U.S. Department of Agriculture<br>Forest Service |
| | U.S. Department of the Interior<br>Bureau of Land Management |
| | U.S. Department of the Interior<br>National Park Service |
| | National Invasive Species Council |
| | Association of Fish and Wildlife Agencies |
| | National Association of State Departments of Agriculture |
| Participating Agencies: | U.S. Department of the Interior<br>Fish and Wildlife Service |
| | U.S. Department of Agriculture<br>Natural Resource Conservation Service |

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# Draft Environmental Impact Statement

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| **Type of Statement:** | Draft Environmental Impact Statement |
| **Area Covered by This Statement:** | The 50 United States, District of Columbia, and all U.S. Territories including American Samoa, Commonwealth of the Northern Mariana Islands, Guam, Puerto Rico, and the U.S. Virgin Islands |
| **Lead Agency:** | U.S. Department of Agriculture<br>Animal and Plant Health Inspection Service |
| **Responsible Official:** | William H. Clay, Deputy Administrator<br>USDA, APHIS, Wildlife Services<br>1400 Independence Avenue, SW<br>Room 1624 South Agriculture Building<br>Washington, DC 20250-3042 |
| **Information Contact:** | Alton Dunaway, Deputy Director Environmental Compliance<br>USDA, APHIS Wildlife Services<br>4700 River Road, Unit 87, Room 2D-07.3<br>Riverdale, MD, 20737–1234<br>(301) 851–4007<br>Alton.Dunaway@aphis.usda.gov |
| **Cooperating Agencies:** | USDA Forest Service<br>201 14th Street, Southwest<br>Washington, DC 20250<br>Contact: Mr. John Sinclair<br><br>U.S. Department of the Interior<br>Bureau of Land Management<br>20 M St. SE<br>Washington, DC 20003<br>Contact: Mr. Geoff Walsh<br><br>U.S. Department of the Interior<br>National Park Service<br>1201 Oak Ridge Drive, Suite 200<br>Fort Collins, CO 80525<br>Contact: Dr. Glenn Plumb |

U.S. Department of the Interior
National Invasive Species Council
1201 Eye Street, NW,
Washington, D.C. 20005
Contact: Mr. Phillip Andreozzi

Association of Fish and Wildlife Agencies
444 North Capitol Street, NW, Suite 725
Washington, D.C. 20001
Contact: Ms. Jennifer Mock Schaeffer

National Association of State Departments of Agriculture
4350 North Fairfax Drive #910
Arlington, VA 22203
Contact: Ms. Amy Hendrickson

**Participating Agencies:**

U.S. Department of the Interior
Fish and Wildlife Service
4401 N. Fairfax Dr. #611
Arlington, VA 22203
Contact: Mr. John Klavitter

U.S. Department of Agriculture
Natural Resources Conservation Service
1621 N. Kent St
Rosslyn, VA 22209
Contact: Ms. Andrée DuVarney

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Cover Photo: USDA APHIS Wildlife Services (D.Johnson)

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# Executive Summary

Feral swine (*Sus scrofa*) are a harmful and destructive invasive species. Feral swine inflict significant damage to property, agriculture (crops and livestock), native species, ecosystems, and historic and cultural resources. They also pose a threat to the health of wildlife, domestic animals, and humans. The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program has been working with Federal, State, Territorial and local agencies; Tribes; organizations; and private individuals to address specific localized feral swine damage problems. These actions have been successful at the local level, but the size and range of the national feral swine population and associated damage is increasing. Cost and complexity of damage management increase as populations increase. There is a need for a national feral swine damage management (FSDM) program to aid Federal, State, Territorial, Tribal, local, and private management efforts to reduce or eliminate feral swine populations, damage, and threats to human and animal health.

This draft environmental impact statement (DEIS) reviews the environmental impacts of alternatives to achieve the APHIS goal of reducing damage to agriculture, natural and cultural resources; property; animal health; and human health and safety in cooperation with agency partners, Tribes, and others. The alternatives are programmatic in nature and are intended to guide APHIS cooperation and interactions with program partners and provide a system for allocation of project resources. Additional State, Territorial, or local level analyses will be prepared, as needed, to address local issues and needs in accordance with the Council on Environmental Quality (CEQ) and APHIS' implementing regulations under NEPA.

In this analysis, the term feral swine is used to refer collectively to free-ranging swine. This term includes escaped (estray) domestic and pet swine and their descendants, Polynesian pigs, and Eurasian wild boar and their hybrids. Terms used by other entities may include wild pig, feral pig, wild hog, and wild boar. Until the late 1980s, feral swine populations in the continental United States were primarily found in the southern tier of states and states on the west coast. Size and range of the population in the mainland U.S. has increased from only a small percentage of counties located in 17 States in 1982 to at least 41 states in 2014. The national feral swine population is currently estimated to exceed more than 6 million individual animals. High reproductive capacity and the ability to adapt to nearly any environment enable feral swine to thrive wherever they are found. Recent rapid range expansion is believed to be primarily due to humans transplanting them to new areas to increase hunting opportunities, either intentionally through release of animals into the wild, or unintentionally through escapes from hunting preserves.

## SCOPE OF THE ANALYSIS

The scope of the DEIS includes all of the United States and its Territories where feral swine exist or may occur. This DEIS concerns only the actions of the APHIS program, carried out directly or in conjunction with agency partners and private organizations and individuals. FSDM actions conducted by entities other than APHIS with funding from APHIS, as allowed under some alternatives, would also be conducted in accordance with provisions of this analysis.

## GOALS AND OBJECTIVES

The following objectives were developed to achieve the program goal of reducing feral swine damage to agriculture, natural resources, property, animal health, and human health and safety. All alternatives except the current program meet the objectives although the extent to which some objectives are met varies among alternatives. Relative ability of alternatives to meet program objectives is detailed in Chapter 4.

- Stabilize and eventually reduce the range and size of the feral swine population in the United States and Territories in accordance with management objectives of States, Territories and Tribes.
- Further develop cooperative partnerships with other pertinent Federal, State, Territorial, Tribal, and local agencies, and private organizations working to reduce impacts of feral swine to agriculture, natural resources, property, animal health, and human health.
- Expand feral swine management programs nationwide to protect agriculture, natural resources, property, animal health, and human health.
- Expand feral swine disease monitoring to protect agriculture and human health.
- Assess disease risk posed by feral swine to domestic swine production and other livestock, and to human health.
- Develop and improve tools and methods to manage feral swine populations, including field tests to assess the efficacy for reducing risks to agriculture, natural resources, property, animal health, and human health.
- Develop predictive models for population expansion and economic impacts of feral swine, along with risk analysis to agriculture, animal health, and human health.
- Develop outreach materials and activities to educate the public about feral swine damage and related activities to prevent or reduce damage.
- Coordinate with Canada and Mexico to establish a collaborative plan to address the feral swine threat along the common borders, including monitoring, research and operational responses as appropriate.

## ALTERNATIVES CONSIDERED IN THE ANALYSIS

All alternatives would be implemented in accordance with applicable Federal laws and in cooperation with Tribes, agencies, and organizations at the State and Territory level. Each of the alternatives includes use of a full range of legally available nonlethal and lethal methods for FSDM. Nonlethal methods considered for use or recommended by APHIS include education and outreach including advice on regulations to address feral swine damage; surveillance (e.g., telemetry, Judas pigs, camera systems, aircraft, and night vision or thermal sensing equipment); exclusion; frightening devices; and repellents. Lethal methods may include shooting (from ground and aircraft); snares; and live capture and euthanasia (via gunshot or euthanasia chemicals). Cage and corral traps; drop nets, snares and cable restraints; and foothold traps may be used for live-capture of swine. The injectable contraceptive, GonaCon™ was analyzed for potential inclusion in the program if it is registered and available for use in feral swine. Toxicants and orally administered reproductive agents are under development, but insufficient information was available to consider them for use at this time.

**Alternative 1: Current FSDM Program**. In this case, the No Action Alternative refers to APHIS FSDM actions prior to the appropriation of additional funds by Congress. It serves as a starting point for comparison with the other alternatives and can be defined as "no change" from the status quo. Congress has acknowledged that feral swine are a harmful and destructive species, and that a federal response to feral swine damage is warranted. Consequently, this No Action Alternative cannot be selected for implementation unless Congress determines that a national FSDM program is no longer a priority.

Under the current program, APHIS-WS State programs provide technical assistance (advice, training, loan of equipment), and, when appropriate and funding is available, operational assistance with lethal and non-lethal FSDM. An Integrated Wildlife Damage Management (IWDM) approach is used which incorporates the use or recommendation of a range of nonlethal and lethal techniques, singly or in combination, to meet the needs of each cooperator.

APHIS-WS personnel opportunistically collect biological samples from some feral swine killed during operational control activities and from other sources (e.g., hunter-killed animals) for disease monitoring. Research, modeling and risk assessment projects are conducted on an array of issues related to feral swine, but are limited by available funding. Most APHIS outreach and education efforts are conducted by personnel at the State and Territory level. Work with Canada and Mexico on FSDM has been primarily limited to interactions between individual APHIS-WS State programs and their Canadian or Mexican counterparts.

**Alternative 2: Integrated FSDM Program (Preferred Alternative).** Under this alternative, APHIS would serve as the lead agency in a nationally coordinated cooperative effort with other agency partners, Tribes, organizations, and local entities. In States, Territories and Tribal lands where management authorities wish to eliminate feral swine (generally areas with low or moderate feral swine populations), APHIS would form partnerships to meet their management objectives and reduce the size and range of the U.S. feral swine population. In States, Territories and Tribal lands where management authorities have chosen to retain some feral swine for cultural or recreational purposes (usually areas with large or well established feral swine populations); APHIS would form partnerships to meet locally determined management objectives. These objectives may include reducing statewide populations or eliminating swine from specific locations. Key program components are threefold:

1. Improved baseline operational capacity to respond including improved infrastructure (e.g. personnel, equipment) and increased cost-share opportunities with partner agencies, Tribes and private entities.
2. National projects including strategic allocation of resources to reduce the range and size of the national feral swine population, increased research, modeling and risk analysis, national outreach and education program, and national coordination with Canada and Mexico.
3. Strategic projects at the local level to address specific vulnerable areas.

**Alternative 3: Baseline FSDM Program**. The Baseline APHIS FSDM Program (Alternative 3) is a nationally coordinated response that improves the baseline operational capacity of APHIS-WS State programs that assist in States, Territories, and Tribal lands with feral swine. This alternative directs the most resources to operational management efforts. National projects and strategic local projects, as described for Alternative 2, are not included. Allocations would be based on the size of the feral swine population in each State and Territory. Increased capacity of APHIS-WS State programs to respond would allow for expanded FSDM including population management in States and Territories, education, outreach, disease monitoring and other activities that may meet national objectives.

**Alternative 4: National FSDM and Strategic Local Projects Program.** This alternative places emphasis on national projects and strategic local projects, as described for Alternative 2. Strategic allocation of resources under this alternative would result no additional FSDM funding for some APHIS-WS programs serving low priority States and Territories until management objectives are achieved in high priority areas. APHIS-WS programs in low priority States and Territories could continue to assist cooperators as currently occurs under Alternative 1.

**Alternative 5: Federal FSDM Grant Program.** Under this Alternative, APHIS would distribute National APHIS FSDM Program funding to States, Territories, Tribes, organizations representing Native peoples, and research institutions. APHIS would not conduct any operational FSDM, research or other activities described under Alternative 2. The National APHIS FSDM Program Manager would administer the Federal FSDM Grant Program to achieve the key project components described for Alternative 2. The grants process would require more resources to administer than Alternative 2; consequently, less overall funding would be available for all aspects of FSDM.

## ENVIROMENTAL CONSEQUENCES

**Alternative 1: Current FSDM Program.** The analysis in Chapter 4 found that the current program, with the inclusion of standardized procedures to minimize risk, may result in the disturbance or take of a limited number of individual non-target animals, but it would not adversely affect any populations. State, national, and local ESA Section 7 consultations have been completed for this program and in no case would this alternative jeopardize the continued existence of any species. The majority of consultations have found that the program would have either no effect, a beneficial effect, or would not be likely to adversely affect any species. Nationwide, adverse impacts of feral swine on non-target species are expected to increase in accordance with increases in the feral swine population.

Use of lead ammunition can pose risks to the environment. Recreational lead ammunition use far exceeds use by the WS program. APHIS-WS would continue to work to reduce its use of lead ammunition for ground shooting within the constraints of availability, safety, efficacy and cost

Most FSDM methods pose little risk to soils, vegetation, and water quality when conducted according to program policies. Direct and indirect damages from feral swine on soils, vegetation and water quality are reduced in project areas, but would be expected to continue to increase at the national level along with the feral swine population.

Carcass disposal is not expected to have a substantive impact on odor or air quality because of compliance with applicable regulations and coordination with landowners/managers. Total estimated CO2-equivalent greenhouse gas emissions from the APHIS –WS program including FSDM activities are well below the Council on Environmental Quality's suggested reference point of 25,000 MT/year of direct emissions for detailed analysis and potential mitigation in a proposed action.

Where feral swine are managed as a game animal, impacts are localized and coordinated with appropriate regulatory agencies to preserve hunting opportunities. Effects on hunting opportunities may vary depending on the management status of feral swine in the State, Territory or Tribal lands, the size of the feral swine population, and how landowners/managers and natural resource agencies choose to manage the swine in their area. Feral swine populations and hunting opportunities have continued to grow under the current program.

The current FSDM program's effect on aesthetics varies based on the personal values of the individuals using resources affected by feral swine. Disturbance to recreationists from FSDM activities is generally minor, short term, temporary and infrequent. Coordination with landowners/managers is used to identify ways to avoid or minimize potential for impacts.

Human health and safety risks from FSDM are low for many reasons including safety policies, training and certification, coordination and agreements with landowners and land managers, adherence to regulations and other program SOPs, and timing and location of the use of methods to minimize public exposure. FSDM is likely to benefit the public by reducing the potential for zoonotic disease transmission, swine-vehicle accidents, and risks from aggressive swine.

The Current Program delivers FSDM only where requested by landowners/managers, including Tribal lands and other areas protected for special cultural or historic values. WS coordinates and consults with the appropriate authorities to prevent adverse effects on cultural or historic resources. Therefore this alternative does not generally have the potential to adversely affect historic properties.

The analysis shows that the current FSDM program is both ethical and humane although perception of the humaneness of FSDM methods varies, depending on individual philosophies and experiences.

The current program helps to reduce economic damage caused by feral swine in limited areas, but overall damage is increasing as the range and size of the feral swine population increases. Hunting preserves, other hunting related business and private pest control operators that control feral swine see some economic benefit from current feral swine populations. They are not likely to be adversely affected by current feral swine removal rates.

**Alternative 2: Integrated FSDM Program.** Impacts on most facets of the affected environment would be similar in nature to Alternative 1 because the methods used for FSDM would be similar. However, the extent of impacts would increase in accordance with the increase in overall FSDM activities. Some risk of adverse impacts may decrease if the increased research that would occur under this alternative identifies ways to improve the efficacy, selectivity and safety risks associated with existing FSDM methods. Expanded and new programs may require supplemented or new consultations with regulatory agencies, such as those required for compliance with the Endangered Species Act and National Historic Preservation Act. With implementation of appropriate protective measures discussed in the DEIS, conclusions similar to Alternative 1 are expected. Based on analysis of the ability of alternatives to meet management objectives, this alternative has the greatest potential for benefits from the reduction of damage and risks to human and animal health caused by feral swine.

Federal funding associated with this alternative would make it possible for the APHIS-WS program to commit to only using lead-free ammunition for aerial operations under this alternative within the constraints of availability. APHIS-WS would continue working to reduce its use of lead ammunition for ground shooting within the constraints of availability, safety, efficacy and cost. This should reduce environmental risks associated with use of lead ammunition.

The Integrated FSDM Program would likely raise estimated cumulative APHIS wildlife damage management program CO2-equivalent greenhouse gas emissions levels but cumulative impacts for the APHIS-WS program would still be below the 25,000 MT threshold for detailed review proposed by CEQ.

Where swine hunting is allowed but eradication is established as the State, Territory or Tribal management goal, hunting opportunities are likely to be reduced directly through reductions in swine densities and indirectly as animals become wary of control actions. Where feral swine are managed as a game animal, hunting opportunities are not likely to be adversely affected.

Additional coordination and consultation with Tribes is likely to be needed because of the increased scope of proposed FSDM activities. Additional resources beyond the current program would be available to assist Tribes with FSDM. Expanded removals in Hawaii and other areas where feral swine have important traditional uses would not affect public hunting because of existing SOPs to preserve hunting opportunities on public lands, but could further reduce availability on private lands over current FSDM program levels.

Ethics and humaneness considerations would be similar to Alternative 1. However, this alternative includes research, outreach/education and technical assistance that could improve the selectivity and humaneness of FSDM methods and overall need for FSDM. Consequently, some individuals may perceive this alternative as more ethical and humane than the current program even though more FSDM will be conducted under this alternative.

Program activities would be likely to provide long term beneficial economic effects from increased efficiencies in FSDM and reduced feral swine damages. Low-income landowners and communities would receive more FSDM benefits than the Current FSDM Program. Businesses that supply FSDM equipment and supplies would initially benefit from increased sales but long term program success would reduce purchases over time. Feral swine hunting businesses, private pest control operators, and people who use feral swine for food could be negatively affected in the long term except where feral swine are managed as a game animal. Legal fenced hunting preserves could benefit from reduced opportunities elsewhere.

**Alternative 3: Baseline FSDM Program.** Environmental effects associated with this alternative are expected to be similar in nature to Alternative 1 because the same methods will be used. However, the extent of impact will be greater than Alternative 1 and slightly greater than analyzed for Alternative 2, because the level of operational FSDM is expected to be greatest under this alternative. SOPs and other protective measures discussed for Alternatives 1 and 2 including compliance with applicable regulations and consultation with Tribes, regulatory agencies and local agency experts, as appropriate, will minimize risks of adverse impacts. Overall risks to the human environment are still likely to be low. Unlike Alternative 2, there would be no increase in research under this alternative or associated increase in potential for benefits from research improvements to FSDM methods.

There would be more operational FSDM and associated reductions in adverse impacts of feral swine under this alternative in the short term. However, this alternative would be less effective in containing or reducing the national feral swine population. Consequently, the need for FSDM is likely to persist longer than under alternatives that use a strategic national approach to contain and reduce the feral swine population (Alternatives 2 and 4).

This alternative would have greater adverse effects on feral swine hunting opportunities than Alternatives 1 and 2 in the short term because it allocates the most funding to operational FSDM. Long term impacts may be less than Alternative 2 because of lower anticipated efficacy in reducing the range and size of the national feral swine population.

Risks to human health and safety associated with specific FSDM methods would be similar in nature to Alternative 1 but greater in extent because it would allocate the most funding to operational FSDM. However, this alternative does not provide additional funding for research, disease monitoring, and education programs which may improve the safety and efficacy of FSDM efforts and better enable agencies to monitor for potential risks from zoonotic diseases in feral swine.

This alternative would be more ethical and humane than Alternative 1 based on improved FSDM capacity over the current program, but less than Alternatives 2 and 4 because there would be no increase in resources for research, outreach/education and technical assistance that could improve the selectivity and humaneness of FSDM methods and reduce the overall need for FSDM.

Economic impacts of the program would generally be similar to Alternative 2. However, under there are likely to be cost inefficiencies associated with the method for allocating resources under this alternative including less coordination in surveillance and population monitoring, delayed response to reports of new populations, lack of projects to address special local and national needs, the inability to adjust and increase resource allocations to accommodate the difficulties in removing the last few feral swine in a State. These factors would increase the costs of removal efforts over time. This alternative would also not benefit from increased research to improve current methods and develop new techniques or improved national disease monitoring that would occur under Alternative 2.

Crop damages alleviated would be greater than Alternative 1, and, at first, could be greater than Alternative 2 because it allocates the most resources to operational FSDM. In the long term, this alternative would be less effective at reducing crop damages than Alternative 2 because it would be less effective in containing and reducing the national feral swine population. Economic impacts on swine hunting, hunting preserves, damage management businesses and individuals who use swine for supplemental food would be greater than the current program, but slightly lower than Alternative 2.

**Alternative 4: National FSDM and Strategic Local Projects Program.** Environmental risks from FSDM activities would be similar in nature to Alternative 1 because the same methods will be used. The primary difference would be in the magnitude and distribution of impacts. Areas identified as priorities for National and strategic local projects may be temporarily subject to increased impacts similar to Alternatives 2 and 3 because FSDM resources would be concentrated for these areas. In low priority areas, impacts would be similar to Alternative 1, until objectives are accomplished in high priority areas and resources are reallocated. SOPs and other protective measures discussed for the other alternatives will minimize risks of adverse impacts. Some risk of adverse impacts may decrease if the increased research that would occur under this alternative identifies ways to improve the efficacy, selectivity and safety of existing FSDM methods.

Potential benefits from achieving national feral swine population management objectives would likely be achieved more quickly for high priority areas under this alternative than under the remaining alternatives. However, adverse impacts from feral swine may increase in some States and Territories which are low priorities for FSDM until resources are reallocated to those areas, similar to what currently occurs under Alternative 1.

Like Alternative 2, this alternative would have a nationally coordinated research component which could help to improve the efficacy and safety of FSDM methods. It would also increase outreach and education efforts which could help inform the public and agencies of ways to minimize safety risks associated with feral swine.

Not all States and Territories would realize economic benefits from FSDM activities over levels which occur under Alternative 1 during the early years of the program. New resources for FSDM will not be allocated to low priority areas until high priority areas are cleared of swine and FSDM resources are reallocated. Delays in improvements to FSDM actions in low priority States and Territories are likely to increase the cost and complexity of FSDM in some of these areas. Impacts on businesses that supply FSDM equipment and supplies, feral swine hunting businesses, private pest control operators, and people who use feral swine for food would shift over time as project objectives are accomplished and concentrated FSDM efforts shift to new locations. However, there would likely be economic benefits to all areas associated with increased research to improve current methods and develop new techniques and improved national disease monitoring similar to Alternative 2.

**Alternative 5: Federal FSDM Grant Program.** There would be little to no direct environmental impacts from APHIS FSDM actions because APHIS would not conduct operational FSDM or implement other national FSDM activities (e.g., research, disease monitoring, outreach and education). However, grants would be issued to support program components similar to those under Alternative 2. Increased cost of program administration and inefficiencies associated with program delivery would reduce the operational funds for FSDM. New ESA consultations would be necessary to implement grant programs. Grant recipients would be expected to implement measures to minimize or avoid adverse environmental impacts similar to those that would be implemented by APHIS, so environmental risks are expected to be similar to but slightly less in scope than Alternative 2 because of the reduction in resources for operational FSDM. Similarly, environmental benefits associated with FSDM would be similar to but lower in magnitude than for Alternative 2. This alternative would not benefit from APHIS-WS operational damage management experience or NWRC research and experience in new product development.

APHIS would be responsible for ensuring that grant recipients followed any applicable SOPs and National Historic Preservation Act requirements. Tribes would not work directly with APHIS-WS but partnerships among Tribes and other agencies would be encouraged. Tribal governments and Native Hawaiian organizations would be able to apply for grants to protect their own resources.

Perceptions of the humaneness and ethics of this alternative are likely to be similar to Alternative 2, with the exception some individuals may consider this alternative unacceptable because of the reduced efficacy of the alternative and because there is some uncertainty regarding grant recipient commitments to implementing the SOPs and other protective measures outlined for APHIS-WS under alternatives 1-4.

Less effective and efficient elimination of feral swine would prolong damages and associated economic losses. Many aspects of the national projects could be implemented by grant recipients, but overall, the national efforts to increase efficiencies (research, education/outreach, monitoring and international collaboration) would be reduced which would increase costs of FSDM and reduce potential for economic benefits from effective feral swine damage management.

# Chapter 1: Purpose and Need for Action

## A. Introduction

Feral swine are a harmful and destructive non-native, invasive species. Their geographic range is rapidly expanding, and their populations are increasing across the United States (U.S.) (Waithman et al. 1999, Barrios-Garcia and Ballari 2012). Feral swine are also known to occur in portions of the U.S. Territories such as American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, Puerto Rico, and the Virgin Islands. Feral swine inflict significant damage to property, agriculture (crops and livestock), native species and ecosystems, and historic and cultural resources. They also pose a threat to the health of wildlife, domestic animals, and humans. Damage and risks to animal and human health are expected to increase as feral swine densities increase and their populations continue to expand across the country. The difficulty in managing swine damage and associated management costs increases as swine populations increase.

This draft environmental impact statement (DEIS) presents alternatives, and reviews the environmental impacts of the alternatives for a U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) national strategy to reduce and, in some areas, eliminate the risks and damage inflicted by feral swine to agriculture, natural resources, and human health.

This chapter provides information on the origin and nature of feral swine in the United States and its Territories; the need for feral swine population control and damage management (FSDM); the purpose and scope of this DEIS; decisions to be made; the goals and objectives of a FSDM program; and the authorities and responsibilities of the lead, cooperating, and participating agencies involved in preparation of this DEIS.

## B. Purpose

The purpose of the proposed action is to develop a nationally coordinated program to reduce feral swine damage and risks to agriculture, animal health, human health, property, and natural resources in the United States and its Territories. APHIS seeks to achieve this goal cooperatively and with the assistance of other agencies at the international, Federal, State, Territorial, Tribal, and local levels, and the cooperation of private management interests. The national feral swine program is intended to guide APHIS interactions with program partners, provide a system for allocation of project resources, and identify management methods which APHIS programs may use to address feral swine damage.

## C. Feral Swine in the United States and Its Territories

In this analysis, the term *feral swine* is used to refer collectively to free-ranging swine (*Sus scrofa*), belonging to the family *Suidae*. This term includes escaped (estray[4]) domestic and pet swine and their descendants, Polynesian pigs, and Eurasian wild boar and their hybrids (Chapter

[4] Estray is a term used to describe a domestic animal found wandering without an owner.

3.B). Terms used by other entities may include wild pig, feral pig, wild hog, and wild boar.

The earliest swine introductions, to what eventually became the United States and its Territories, occurred in Hawaii, American Samoa, CNMI, Guam, where swine arrived with early human settlers from Southeast Asia (Larson et al. 2007, American Samoa Historic Preservation Office 2014). Christopher Columbus is believed to have brought the first European domestic swine to North America in 1493 (West Indies). The Spanish explorer Hernando de Soto is credited with the first recorded introduction of European domestic swine to mainland North America in Florida in 1539 (Wood and Barrett, 1979). European settlers and explorers made subsequent similar introductions to other portions of the United States and its Territories. Historic swine production practices commonly involved allowing the swine to range free outside fenced pastures and pens. Escaped animals and animals from free-ranging domestic herds formed the basis of the feral swine population in the United States and its Territories. In the early 1890s, Eurasian wild boar were first introduced to North America for use in fenced hunting preserves, with subsequent introductions to fenced and unfenced areas.

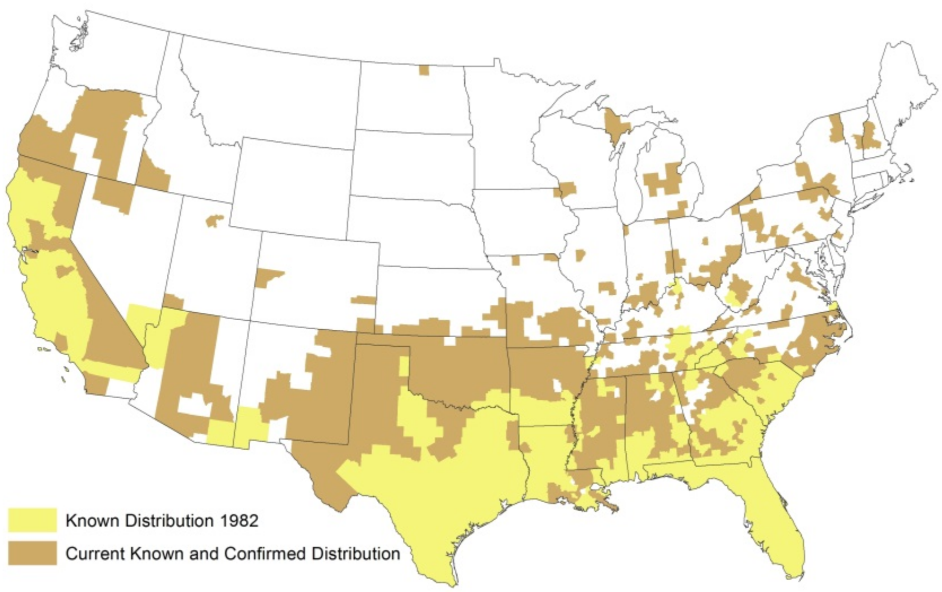


**Figure 1-1.** Known and confirmed feral swine range in (2012) compared with historic 1982 range. (Miller and Sweeney 2013, National Feral Swine Mapping System (http://swine.vet.uga.edu/nfsms/)).

Until the late 1980s, feral swine populations in the continental United States were primarily found in the southern tier of States and States on the west coast. In 1982, feral swine were thought to occur in only a small percentage of counties located in 17 States (Mayer and Brisbin 1991, Miller and Sweeney 2013, National Feral Swine Mapping System (http://swine.vet.uga.edu/nfsms/)). Over the past several years, their numbers have increased significantly. Feral swine are now known to exist in at least 38 States (Figure 1-1) and the above-mentioned Territories. Based on data from APHIS Wildlife Services' (APHIS-WS) National Wildlife Disease Program (NWDP), the Southeastern Cooperative Wildlife Disease

Study, and APHIS' Veterinary Services (APHIS-VS), feral swine are now present in approximately 40% of all counties in the United States (Figure 1-2). The national feral swine population is currently estimated to exceed more than 6 million individual animals (Mayer 2014).

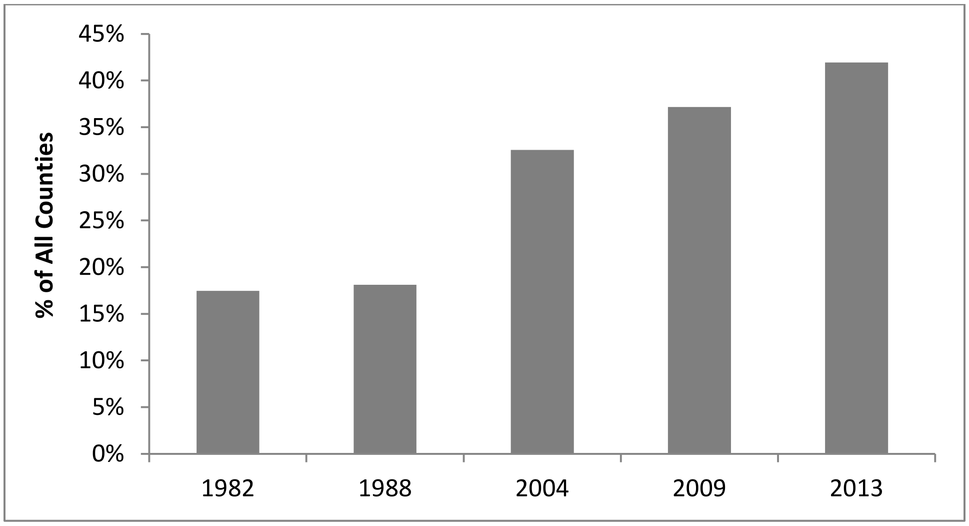


**Figure 1-2.** The percentage of counties in the United States with feral swine present from 1982 to 2013 (APHIS unpublished data).

Feral swine populations have increased and expanded for a number of reasons. High reproductive capacity and the ability to adapt to nearly any environment enable feral swine to thrive wherever they are found. Feral swine are also a prized game animal for some hunters because of their size, intelligence, and reputation for aggressive behavior, (e.g., wildhoghunters.com, boarmasters.com 2013; also, see Chapter 3), as well as the meat they provide. Recent rapid range expansion is primarily due to humans transplanting them to new areas to increase hunting opportunities, either intentionally through release of animals into the wild, or unintentionally through escapes from hunting preserves (Waithman et al. 1999). Additionally, large-scale weather events, such as hurricanes, can force coastal populations of feral swine to move inland (Shaw 2013).

Difference Between Non-native Invasive Feral Swine and Native Collared Peccary

Feral swine addressed in this DEIS should not be confused with the native collared peccary (*Pecari tajacu*, aka javelina) which may be found in portions of Texas, New Mexico, and Arizona (Figure 1-3). Collared peccary are not involved in the same scale of conflicts as feral swine and will not be targeted by any of the FSDM alternatives presented in this DEIS. Although the visual appearance of the animals may appear similar, collared peccary are not pigs and belong to a different taxonomic family (*Tayassuidae*) than feral swine. For this reason, the collared peccary and feral swine do not interbreed (Livia 2011).

Collared peccary have coarse salt and pepper colored fur with a band of white around the neck that resembles a collar (Figure 1-4). Some differences between the collared peccary and feral swine are listed in Table 1-1.

**Figure 1-3.** Range of collared peccary in the United States. Collared peccary, although pig-like, are native to North America and should not be confused with feral swine (Natureserve 2014).

**Figure 1-4.** Collared peccary are native to North America and should not be confused with non-native, invasive feral swine. (NPS photo - Cookie Ballou).

**Table 1-1.** Differences between native collared peccary and non-native, invasive feral swine (NPS 2006).

| | Collared Peccary | Feral Swine |
|---|---|---|
| Classification | Family Tayassuidae | Family Suidae |
| Origin | Native to the Americas | Introduced from Europe or Asia |
| Size | 40–60 pounds | In general, up to 400 pounds |
| Stomach | Complex stomach | Simple stomach |
| Scent Gland | Scent gland present | No scent gland |
| Teeth | 38 teeth with straight incisors | 36 or 44 teeth with curved incisors |
| Toes | 3 toes on hind feet | 4 toes on hind feet |
| Tail | Vestigial tail | Short tail |
| Legs | Limb bones partially fused | Limb bones not fused |

## D. Need for Action

Feral swine can cause significant damage to agricultural and natural resources and property, and they pose risks to human and animal health. The International Union for Conservation of Nature (IUCN), Invasive Species Specialist Group (ISSG) has included feral swine in their listing of "100 of the World's Worst Invasive Alien Species" (Lowe et al. 2000). In accordance with program authorities (Section H below), the APHIS-Wildlife Services (WS) program has been working to address specific localized feral swine damage problems. Although many of these actions have been successful at the local level, numbers of feral swine, their range, and associated damage is increasing in many parts of the country. Cost and difficulty of damage management increase as populations increase. There is a need for a nationally coordinated FSDM program to aid Federal, State, Territorial, Tribal, local, and private management efforts to reduce damage, and threats to human and animal health from feral swine. A national strategy may also help Federal agencies, States, Territories, and Tribes in preventing feral swine from spreading to areas where they do not already occur, and in effectively responding to incipient or low populations.

This section provides a summary of the types of damage and risks to human and animal health associated with feral swine. Detailed discussion of the impacts of feral swine is provided in Chapter 3: Affected Environment.

### 1. Damage to Agriculture

Feral swine are considered a major emerging threat to American agriculture (Seward et al. 2004). Recent data shows the proportion of U.S. counties with agricultural production that also have feral swine present. Over the period of 1998–2013, the proportion of counties with dairy, hog, and crop production that are affected by feral swine has increased. While most large commercial farms have strong biosecurity measures in place to minimize the chance of contact between feral swine and domestic herds, smaller transitional herds may be more at risk of threats associated with feral swine. In addition to the direct damage and disease risks discussed below, disease outbreaks, which substantially impact interstate and international trade, would not only impact livestock producers, but also grain producers, particularly corn and soybean farmers, transportation industry and others.

### *a. Crop Damage*

Feral swine damage crops through direct consumption of crops and other behaviors, such as rooting, trampling, and wallowing, which can destroy fields or reduce productivity. Field crops commonly damaged by feral swine include sugar cane, corn, grain sorghum, wheat, oats, peanuts, and rice, among others. Vegetable and fruit crops, such as lettuce, spinach, melons, and pumpkins are also damaged (Schley and Roper 2003, Seward et al. 2004). Rooting out seeds and trampling seedlings impacts regeneration of forest plantations (Lipscomb 1989). Feral swine also can reduce the vigor of larger trees, retarding growth or causing a decline in nut crops, such as pecans and almonds (Campbell and Long 2009*a*).

### *b. Predation on Livestock*

Feral swine are omnivorous. They will kill calves and lambs, and also occasionally kill adult animals that are vulnerable while giving birth (Pavlov and Hone 1982, Choquenot et al. 1997).

### *c. Disease Risk to Livestock and Potential for Impact on International Trade*

Feral swine can serve as hosts for endemic diseases readily transmissible to domestic livestock. Livestock diseases cause economic loss through morbidity, mortality, decreased production, decreased feed efficiency, lower reproductive success, and the costs associated with veterinary diagnostics and treatment.

Severity of impact depends on several factors, including type of disease, size of operation, and spread before detection. Feral swine have been implicated in both increasing the likelihood of a disease event and potentially extending a disease event if one occurs (Meng et al. 2009). A foreign animal disease (FAD) is a disease that is not found in the United States. These diseases may have been in the United States at one point, but have been eradicated or have never been present in this country. Feral swine could potentially play a role in the spread of a FAD. Emergence of a FAD could cause substantial damage to America's economy. A FAD outbreak would not only negatively impact livestock producers and trade, but also grain producers, corn and soybean farmers, energy companies, and manufacturing jobs, among others.

#### *d. Other Agriculture Damage*

Feral swine damage pasture grasses and consume, contaminate, and destroy supplemental feed and mineral sources provided for livestock (Wigley 1995, Bach and Conner 1997). Feral swine also damage farm facilities, such as fences, water supplies, irrigation ditches, guzzlers (West et al. 2009), and rice field levees (Bennett 2013).

### 2. Damage to Natural Resources

#### *a. Habitat Damage*

Feral swine consume large quantities of herbaceous vegetation (3–5% of their body weight daily) and have been linked to 95% declines of understory vegetation in some systems (Cole et al. 2012). Understory animal species (from arthropods to mammals) decline with the absence of understory vegetation (Singer et al. 1984). Rooting, soil compaction, and wallowing influence plant community structure, succession patterns, and nutrient cycles. Consumption of seeds, nuts, and seedlings also reduces the potential for forest regeneration (Campbell and Long 2009*a*), and may influence future over-story composition and reduce tree diversity directly through consumption of seeds (Tolson and LaCour 2013). Sites disturbed by rooting and wallowing are often vulnerable to erosion and colonization by non-native invasive plant species which often prefer disturbed sites and become established more quickly than many native plants. In some habitats, feral swine may preferentially browse or uproot protected, sensitive, unique, or rare plant species.

Habitat damage by feral swine can be most pronounced in wet environments where plant communities and soils may be more sensitive to disturbance (Engeman et al. 2003, 2004; West et al. 2009). Near waterways, this can result in destabilization of banks. Unfortunately, these types of areas are often preferred by feral swine. Wet soils may make it easier for feral swine to obtain some of the foods they favor, such as the roots, tubers, and bulbs that are characteristic of many wetland ecosystems.

Federal land management agencies, Federal agencies such as the USDA Natural Resources Conservation Service (NRCS), and State, Territorial, Tribal, local, and private land management agencies and organizations continually work to preserve and restore habitat for native species. When resources must be used to restore sites damaged by feral swine, that money is not available for other essential projects.

#### *b. Impacts on Wildlife*

Feral swine diets overlap with those of native wildlife, including threatened or endangered (T&E) species, which may result in competition for important and limited natural food supplies, although documentation of competition is limited (Mayer 2009*a*, Barrios-Garcia and Ballari 2012). Mast crops[5] are a preferred food of feral swine and also a critical food source for many native wildlife species. Consumption of seeds, seedlings, and other vegetation reduces availability for native species (Campbell and Long 2009*a*, Mayer 2009*a*). Feral swine are omnivorous and will prey on many smaller native animals and invertebrates, including some T&E species such as insects, earthworms, voles, shrews, turtles, amphibians, and shrub- or ground-nesting birds. Feral swine will destroy nests and consume eggs of reptiles and ground-nesting birds, such as alligators (Elsey et al. 2012), quail, turkey, and shorebirds (Campbell and Long 2009*a*). In some areas, feral swine can have adverse impacts on T&E species and their habitats and are a factor in the continuing endangerment of multiple plant and animal species (Waithman et al. 1999, Gurevitch and Padilla 2004, Engeman et al. 2010). The preference of feral swine for wet environments also creates competition for limited water resources with native wildlife during dry seasons in generally arid environments.

Feral swine also can serve as hosts for and transmit diseases to wildlife. Some of these diseases, such as pseudorabies and other pathogens, can be fatal to wildlife, including T&E species (Pedersen et al. 2013). Feral swine have also been implicated in the promotion of mosquito habitat. Mosquito habitat and increases in mosquito populations contribute to the prevalence of avian malaria and avian pox which impacts native birds (NPS 2013).

### *c. Water Quality Impacts*

Soil disturbance and vegetation loss associated with trampling, wallowing, and rooting by feral swine increases erosion and associated problems with water contamination and siltation. Siltation and water contamination in stream reaches and coastal areas with swine activity have contributed to declines in aquatic organisms, including freshwater mussels and insects (West et al. 2009).

In some areas, feral swine have been implicated as the cause of elevated waterborne bacteria levels in streams, including levels which exceeded thresholds for the protection of human health (Kaller et al. 2007). Feral swine also serve as vectors in the spread of bacteria and parasites in surface waters and soils associated with agricultural production (Atwill et al. 1997, Cooley et al. 2007, Jay et al. 2007). Use of contaminated water for irrigation of foods marketed for direct human consumption could lead to food illness outbreaks.

[5] Mast crops collectively refers to fruit of woody plants that are high in fats, carbohydrates, and protein (such as acorns, nuts, and berries).

## 3. Damage to Property

### *a. Landscaping, Golf Courses, Gardens, and Other Structures*

Feral swine foraging, rooting, and wallowing can damage landscaping, golf courses, recreational fields, cemeteries, parks, and lawns. Rooting by feral swine also damages roadsides, dikes, and other earthen structures.

### *b. Vehicle Collisions*

On average, adult feral swine weigh from 75–250 pounds depending on ancestry and local environment, with individual animals weighing considerably more (West et al. 2009). Consequently, collisions with vehicles such as motorcycles, automobiles, and aircraft can cause substantial damage.

### *c. Conflicts with Pets*

Other damage to property includes feral swine attacks on domestic dogs. For example, in two separate reports, feral swine attacked domestic dogs in Tioga County, New York, killing one dog and injuring another (USDA 2010).

Additionally, feral swine can transmit diseases, including pseudorabies, to pets. Dogs, particularly hunting dogs, become infected with pseuorabies after coming into contact with infected feral swine. Once a dog is infected, there is no treatment, and death typically occurs 48–72 hours after symptoms appear (HAID 2014).

## 4. Damage to Sociocultural Resources

The agencies preparing this DEIS recognize that impacts on some sociocultural resources are relative. An impact that one person perceives as negative may be perceived as positive by another individual, or at least offset by other positive values. (Sociocultural resources affected by feral swine are discussed in detail in Chapter 3: Affected Environment, and are discussed briefly below.)

### *a. Recreation*

Feral swine are not a part of native ecosystems in the United States and its Territories and, therefore, can damage these ecosystems. Depending on the values of the individual recreationists, the presence of feral swine (or feral swine damage) can either negatively or positively impact the enjoyment of the recreationists. Feral swine activities influence the distribution and abundance of native plants and animals, generally reducing opportunities for recreationists to view native wildlife. The destruction and irreversible degradation of cultural resources caused by feral swine activities also reduce opportunities for the public to enjoy these resources. Potential for adverse impacts on recreational experience may be greatest in wilderness areas.

Feral swine can also adversely impact abundance and distribution of native species sought by licensed hunters, trappers, and fishermen. Consequently, although feral swine hunting has value to some individuals, the presence of feral swine may adversely impact opportunities to hunt native species.

#### *b. Aesthetics*

Sites damaged by feral swine rooting and trampling behavior include parks, historic sites and other locations, including private property, valued for their aesthetic beauty and/or cultural importance. Rooting and wallowing by feral swine causes physical damage to these sites, and adversely impacts the aesthetic enjoyment of these locations for some individuals.

For the purpose of this analysis, aesthetic values also include existence value. Existence value is the enjoyment that some individuals have in knowing that something exists even though they personally may never view or experience the resource in question. Knowledge that a valued resource is being adversely impacted by feral swine can adversely impact existence values.

#### *c. Cultural Resources*

Cultural sites impacted by feral swine have included national historic sites, Tribal sacred sites and burial grounds, cemeteries, and archaeological sites and digs (Native American and European origin). Feral swine cause destruction or irreversible degradation of surface and subsurface archaeological sites, historic structures, cultural landscapes, or ethnographic resources and traditional cultural properties. Feral swine damage can affect the significance and integrity of historic properties through physical disturbance to structures, vegetation, and soils. Foraging and habitat damage by feral swine can adversely impact the distribution and abundance of plants and animals which may be used for traditional purposes.

### 5. Human Health and Safety

#### *a. Disease Transmission*

Feral swine can carry at least 30 viral and bacterial diseases, and nearly 40 parasites that may affect humans, domestic livestock, and wildlife species (Ruiz-Fons et al. 2008, Meng et al. 2009). Feral swine can also harbor the causative agents of important foodborne diseases (e.g., E. coli, toxoplasmosis, and trichinosis). Domestic swine are important intermediate hosts for reassortment of influenza A viruses of avian, swine, and human origin, potentially leading to the generation of new strains of influenza (Clavijo et al. 2012).

#### *b. Vehicle Collisions and Habituated/Aggressive Animals*

Feral swine collisions with vehicles and aircraft result in damage to property (Section 3.b. above) and pose substantial risks to the safety of drivers/pilots and passengers. Additionally, feral swine in urban and suburban areas become less wary of human presence over time. In November of 2014, a feral swine initiated an unprovoked attack on a woman walking her dogs in Solano County, California, repeatedly cutting her with its tusks. This is thought to be the first unprovoked attack by a feral swine on a human in California. Feral swine have aggressively approached golfers, picnickers, and others recreating in urban and suburban parks (Colorado State University 2012*a*, Mayer 2013). This behavior may be particularly problematic where they have come to associate humans with food because of feeding, improper food storage, or waste disposal. The potential for animals to become habituated to human resources, then become aggressive towards humans is seen in many species (e.g., bears at camp sites) exists and may become more of a risk for feral swine particularly if they are fed by humans, intentionally or unintentionally.

## E. Scope of EIS

This DEIS is national in scope, and analyzes the APHIS FSDM program to be carried out by APHIS programs directly or in *conjunction* with other Federal, State, Territorial, Tribal, and local governments, and private entities. This DEIS examines the potential consequences of implementing a range of alternatives that could be adopted as a national feral swine management program. As a Federal Government agency subject to the requirements of the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321–4347), APHIS prepared this DEIS in accordance with the applicable implementing and administrative regulations (40 CFR 1500–1508; 7 CFR part 372).

### 1. Geographic Scope

The scope of the DEIS includes all areas in the United States and its Territories. Currently, feral swine are known to occur in the following Territories: American Samoa, CNMI, Guam, Puerto Rico, and the Virgin Islands. Management actions could also be conducted in areas where feral swine currently do not occur to aid Federal, State, Territorial, and local agencies (hereafter referred to as agency partners), Tribes, private organizations, and individuals in preventing feral swine from becoming established in new areas.

### 2. Relationship to Other Agency, Tribal, and Private Actions

This DEIS concerns only the actions of the APHIS program carried out by APHIS directly or in conjunction with agency partners and private organizations and individuals. Under some alternatives, APHIS could pass funding for some types of FSDM to other entities. FSDM implemented by APHIS partners under some alternatives with funding from APHIS would be conducted in accordance with provisions of this analysis.

However, APHIS may allocate portions of funding for administrative overhead and monitoring to ensure compliance with conditions of the grant program (Alternative 5). Actions by other entities to manage feral swine damage on their own, but not with APHIS funding, are not in any way constrained by the management decision made by APHIS based on this DEIS. Such actions are constrained only by applicable Federal, State, Territorial, and Tribal laws, local ordinances, pesticide label instructions, and self-imposed constraints.

Although other agency partners, Tribes, and private entities can and are conducting FSDM on their own, several of the alternatives in this DEIS, including the preferred alternative, involve building partnerships with these entities to address feral swine problems, and provide national-level coordination, finances, and leadership of FSDM. Consequently, this analysis and associated management decisions have the potential to influence future actions by others. Several key partners have contributed to developing the DEIS, and some cooperating and participating agencies may adopt the EIS for their own use. Entities may use their own resources to achieve a component of the management goals identified in a national feral swine management strategy, making it possible to allocate Federal resources to other components of the problem. Similarly, as discussed above in this section, actions and resource allocations resulting from this plan may make Federal, State, Territorial, Tribal, local, or private resources available for other feral swine management or natural resources management actions.

## F. Decisions to be Made—Decision Framework

APHIS is the lead agency in the preparation of this analysis. The primary programs within APHIS that respond to feral swine damage and conflicts are: 1) APHIS-WS, which provides research, advice (technical), and hands-on (operational) assistance with FSDM and disease monitoring; 2) APHIS-VS, which works to protect and improve the health, quality, and marketability of U.S. animals, animal products, and veterinary biologics, including providing technical and operational assistance in the management of potential disease transmission risks involving feral swine; and 3) APHIS - International Services (APHIS-IS) which has the authority to work with Canada and Mexico on feral swine management to protect and promote U.S. agricultural health (see section H below). APHIS-WS is the APHIS program with technical expertise in management of damage by wild and feral animals. Actions in the field are the activities most likely to have impacts on the human environment and, therefore, APHIS-WS is the lead program within APHIS for this project.

Based on the scope of this DEIS, the decisions to be made are:

- What is the best national strategy for allocating APHIS resources, and for working with cooperators to meet FSDM program objectives?
- Which of the FSDM methods are appropriate for inclusion in a national FSDM program?
- What are the anticipated environmental impacts of the alternatives for APHIS' involvement in a nationally coordinated FSDM program?

The decision to be made based on this analysis is programmatic in nature, and will serve as the primary guide for management of feral swine damage. The selected alternative will define the general strategy for FSDM and specific management methods available for use at the local and national level. When deciding on management actions in cooperation with agency partners, Tribes, and other entities, APHIS may choose to implement all or a portion of the methods approved for use in the Record of Decision for the EIS. Additional State, Territorial, or local level NEPA analyses will be prepared, as needed, to address local issues and needs in accordance with the Council on Environmental Quality (CEQ) and APHIS' implementing regulations under NEPA.

The U.S. Department of the Interior (DOI)-National Park Service (NPS) and Bureau of Land Management (BLM), USDA Forest Service (USFS), National Invasive Species Council (NISC), Association of Fish and Wildlife Agencies (AFWA), and the National Association of State Departments of Agriculture (NASDA) are cooperating agencies in the preparation of the analysis. The DOI-Fish and Wildlife Service (FWS) and USDA Natural Resource Conservation Service (NRCS) are also participating in the preparation of the analysis.

## G. Goals and Objectives

APHIS' overall goal is to reduce damage to agriculture, natural resources, property, animal health, and human health and safety in the United States, American Samoa, CNMI, Guam, Puerto Rico, and the Virgin Islands in cooperation with agency partners, Tribes, and others.

The following objectives were developed to achieve the overall goal of reducing or eliminating feral swine damage through the alternatives discussed in this document:

<u>Specific Objectives</u>

- Stabilized and eventually reduce the range and size of the feral swine population in the United States in accordance with management objectives of States, Territories and Tribes. Program objectives include eliminating feral swine from 2 States in the first 5 years; continuing to eliminate feral swine from additional States, on average eliminating feral swine from 2 States every 5 years; and stabilizing the increase in feral swine damage within 10 years of program initiation.

- Further develop cooperative partnerships with other pertinent Federal, State, Territorial, Tribal, and local agencies, and private organizations working to reduce impacts of feral swine to agriculture, natural resources, property, animal health, and human health.

- Expand feral swine management programs nationwide to protect agriculture, natural resources, property, animal health, and human health.

- Expand feral swine disease monitoring to protect agriculture and human health.

- Assess disease risk posed by feral swine to domestic swine production and other livestock, and to human health.

- Develop and improve tools and methods to manage feral swine populations, including field tests to assess the efficacy for reducing risks to agriculture, natural resources, property, animal health, and human health.

- Develop predictive models for population expansion and economic impacts of feral swine, along with risk analysis to agriculture, animal health, and human health.

- Develop outreach materials and activities to educate the public about feral swine damage and related activities to prevent or reduce damage.

- Coordinate with Canada and Mexico to establish a collaborative plan to address the feral swine threat along the common borders, including monitoring, research and operational responses as appropriate.

## H. Lead, Cooperating, and Participating Agency Authorities and Roles

### Lead Agencies

#### 1. USDA, Department of Agriculture, Animal and Plant Health Inspection Service-Wildlife Services (APHIS-WS)

USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife (Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426–426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329–331, 7 U.S.C. 426c). Within the USDA, this authority has been delegated to the APHIS-WS program. APHIS-WS' mission, developed through its strategic planning process (USDA, 1999), is: 1) "*to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety*." APHIS-WS recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature, however, wildlife is a highly dynamic and mobile resource that can cause damage to agriculture and property, pose risks to human health and safety, and affect industrial and natural resources. APHIS-WS conducts programs of research, technical assistance, and applied management to resolve problems that occur when human activity and wildlife conflict.

APHIS-WS is a cooperatively funded, service-oriented program. Before any operational wildlife damage management is conducted, a Work Initiation Document, or similar document, must be completed by APHIS-WS and the landowner/administrator. APHIS-WS cooperates with other Federal, State, Tribal, and local government entities, educational institutions, private property owners and managers, and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable Federal, State, and local laws.

## 2. USDA, Animal and Plant Health Inspection Service-Veterinary Services (APHIS-VS)

As the nation's veterinary authority, APHIS-VS' vision is to improve the health, productivity, and quality of life for animals and people, and maintain and promote the safety and availability of animals, animal products, and veterinary biologics. The primary authority for the APHIS-VS program is the Animal Health Protection Act (7 U.S.C. 8301 et seq.).

The APHIS-VS program works in a variety of ways to protect and improve the health, quality, and marketability of U.S. animals, animal products, and veterinary biologics by (1) preventing, controlling, and/or eliminating animal diseases, and (2) monitoring and promoting animal health and productivity. APHIS-VS contributes leadership, expertise, infrastructure, networks, and systems to collaborate effectively with local, Tribal, State, national, and international partners on animal health issues. APHIS-VS' comprehensive and integrated surveillance activities provide the capability to achieve national goals for animal disease prevention, detection, and early response. APHIS-VS has extensive experience in mitigating animal health risks and documenting feral swine disease information for the protection of health and trade of livestock, and has promulgated regulations in 9 CFR § 78.30 to specifically address disease in feral swine, primarily through regulation of the interstate movement of swine (Chapter 3: Regulatory Environment).

## 3. USDA, Animal and Plant Health Inspection Service-International Services (APHIS-IS)

APHIS works to protect the health and value of American agriculture and natural resources. APHIS-IS supports this mission in an international environment by: (1) safeguarding the health of animals, plants, and ecosystems in the United States; (2) facilitating safe agricultural trade; (3) ensuring effective and efficient management of internationally based programs; and (4) investing in international capacity-building through various training programs abroad to enhance technical, administrative, and diplomatic skills, and competencies. APHIS-IS' international mission is to protect and promote U.S. agricultural health through internationally based animal and plant health expertise. Feral swine occur in and are issues for Canada and Mexico, as is movement of feral swine to and from the United States. APHIS-IS can aid in the development of partnerships with these countries to address mutual concerns regarding feral swine damage and the movement of feral swine.

## Cooperating Agencies

### 4. USDA, Forest Service (USFS)

USFS has the responsibility to manage the resources of National Forest System lands (National Forests and National Grasslands) for multiple uses including timber production, recreation, and wildlife habitat, while recognizing the State's authority to manage wildlife populations. The USFS recognizes the importance of reducing feral swine damage on lands and resources under its jurisdiction, as integrated with its multiple use responsibilities. Occasionally, wildlife damage management actions may also be taken on National Forest System lands to protect resources on adjacent properties. For these reasons, USFS has entered into a national Memorandum of Understanding (MOU) with APHIS-WS to facilitate a cooperative relationship. USFS is a cooperating agency in the preparation of this DEIS.

### 5. DOI, Bureau of Land Management (BLM)

Similar to USFS, BLM has the responsibility to manage the resources on Federal and public lands for multiple uses, including livestock grazing, timber production, recreation, and wildlife habitat. BLM also recognizes the role and importance of wildlife damage management as a component of natural resources management, and has entered into a national MOU with APHIS-WS to facilitate a cooperative relationship. BLM is a cooperating agency in the preparation of this DEIS.

### 6. DOI, National Park Service (NPS)

The Organic Act of 1916 established the NPS with a mandate " *... to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*" The Redwood National Park Expansion Act (Pub. L. 95–250) amended the Organic Act to state that all park management activities shall be, *"[C]onducted in light of the high public value and integrity of the National Park System and not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.*" As a general rule, NPS has broad authority to manage wildlife and other natural resources within the boundaries of units in the National Park System. NPS is directed and has authority to manage its lands and resources (including native and non-native animals) in a manner consistent with Federal legislation, servicewide NPS guidelines and directives, and park-specific management policies and objectives.

As stewards of public lands, NPS protects resources through a variety of internal programs, and strives to be an active conservation partner with other Federal agencies. NPS currently manages 401 sites (generally referred to as "parks"), comprising over 84 million acres. These sites include national parks, national monuments, national seashores, national historic sites, national battlefields, national historic trails, national scenic rivers, national recreational rivers, and national recreational areas. Additionally, NPS administers the National Historic Landmark, the National Natural Landmark, and the National Heritage Areas Programs. NPS agrees that a national coordinated effort is needed to effectively address growing problems associated with feral swine, and is a cooperating agency in the preparation of this EIS.

### 7. National Invasive Species Council (NISC)

NISC was established in 1999 by Executive Order (EO) 13112 to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient. NISC is co-chaired by the Secretaries of the Interior, Agriculture, and Commerce. Other NISC members include the Secretaries of State, Defense, Homeland Security, Treasury, Transportation, Health and Human Services, the U.S. Trade Representative (USTR), as well as the Administrators of the U.S. Environmental Protection Agency, National Aeronautics and Space Administration, and the U.S. Agency for International Development. NISC provides high-level interdepartmental coordination of Federal invasive species actions, and works with other Federal and non-Federal groups to address invasive species issues at both the regional and national levels; this includes assisting as a cooperating agency in the preparation of this DEIS. NISC duties are to:

- Establish and facilitate an advisory committee (The Invasive Species Advisory Committee (ISAC)), under the Federal Advisory Committee Act, to provide information and advice on invasive species issues for consideration by the Federal Government;

- Encourage planning and action at State, Tribal, local, regional, and ecosystem-based level to achieve strategic goals;

- Develop recommendations for international and regional cooperation;

- Facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor invasive species impacts; and

- Prepare and revise National Invasive Species management plans.

### 8. Association of Fish and Wildlife Agencies (AFWA)

The AFWA represents North America's fish and wildlife agencies to advance sound, science-based management and conservation of fish and wildlife and their habitats, in the public interest. The AFWA also provides member agencies with coordination services on cross-cutting, as well as species-based programs which range from birds, fish habitat, and energy development to climate change, wildlife action plans, conservation education, leadership training, and international relations. State fish and wildlife agencies have responsibility for the management and protection of natural resources which may be adversely impacted by feral swine. In some States, the fish and wildlife agency may also have responsibility for managing free-ranging feral swine, swine hunting (including fenced hunting facilities), and other facets of feral swine management (e.g., movement and release of swine). The AFWA is a cooperating agency in the preparation of this DEIS.

### 9. National Association of State Departments of Agriculture (NASDA)

NASDA represents the State departments of agriculture in the development, implementation, and communication of sound public policy, and programs that support and promote the American agricultural industry while protecting consumers and the environment. Depending on State organizational structure, State departments of agriculture have technical expertise and regulatory responsibility for the protection of the health of domestic swine and other domestic animals, including commercial production of wild-type swine, swine hunting preserves, movement of swine, escaped swine, and free-ranging feral swine. NASDA is a cooperating agency in the preparation of this DEIS.

## Consulting Agencies

### 10. DOI, Fish and Wildlife Service (FWS)

The mission of FWS is: “Working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefits of the American people.” FWS manages the 150-million acre National Wildlife Refuge System of more than 561 national wildlife refuges, thousands of small wetlands, and other special management areas. While some of FWS’ responsibilities are shared with other Federal, State, Tribal, and local entities, FWS has special authorities in conserving migratory birds, endangered species, certain marine mammals, nationally significant fisheries, and enforcing Federal wildlife laws.

The agency enforces Federal wildlife laws, administers the Endangered Species Act (ESA), manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat (e.g., wetlands), and helps foreign governments with their conservation efforts in cooperation with other Federal, State, Territorial, Tribal, and local entities. The 2013 Refuge Annual Performance Plan lists 100 refuges in 16 States that have feral hog issues, and identifies feral swine as one of their top 5 invasive species in need of control. In some areas, feral swine damage wetlands and are a danger to T&E species and their habitats. Additionally, feral swine compete with white-tailed deer on refuges by destroying habitat and consuming mast crops (Ray, 1988), as well as by preying on white-tailed deer fawns (Seward et al., 2004). Consequently, the FWS refuge program has participated in the preparation of this EIS. Authorities pertaining to the movement of feral swine on and off national wildlife refuge lands include:

The National Wildlife Refuge System Administration Act (16 U.S.C. 668dd–ee, regulated through 50 CFR). This Act establishes the National Wildlife Refuge System, and requires the agency, “to administer lands to provide for the conservation of fish, wildlife, plants and their habitats and to ensure that biological integrity and diversity is maintained." National wildlife refuges are closed to public uses (by statute, regulation, and authority) until specifically designated as open. Prior to opening sites for public use, FWS must determine if the use is consistent with the purposes of the refuge and the mission of the National Wildlife Refuge System. This latter authority is unique to the National Wildlife Refuge System.

Additional regulations on management of federal lands pertinent to the feral swine issue can be found in 50 CFR:

- § 27.52 - Introduction of plants and animals. Plants and animals or their parts taken elsewhere shall not be introduced, liberated, or placed on any national wildlife refuge except as authorized.

- § 27.21 - General provisions. No person shall take any animal or plant on any national wildlife refuge, except as authorized under 50 CFR 27.51 and parts 31, 32, and 33 of this subchapter C. We [FWS] regulate the removal of plants and animals.

In addition, FWS has authority to issue refuge Special Use Permits (50 CFR part 25), and routinely uses them to authorize permitted activities on a specific refuge. FWS can establish conditions to a permit for public safety and resource protection. Permit conditions are enforceable by administrative revocation and/or criminal prosecution. Title 16 of the Lacey Act (16 U.S.C. 3371–3378) specifies that it is unlawful for any person to import, export, transport, sell, receive, acquire, or purchase any fish or wildlife or plant taken, possessed, transported, or sold in violation of any law, treaty, or regulation of the United States or in violation of any Indian tribal law, or to attempt to do so, whether in interstate or foreign commerce. This law provides the authority to FWS to enforce Federal, State, and Tribal laws, including managing the movement or injurious or other prohibited species in interstate and foreign commerce. Violations can include felony charges.

Under Title 18 of the Lacey Act (18 U.S.C. 42), the injurious wildlife provisions, importation and interstate transport of animal species determined to be injurious is prohibited. Regulation of transport or use within a State is the responsibility of each State, and is not regulated by an injurious wildlife listing. Movement onto or off of FWS (and other Federal) lands with interstate transportation is prohibited. Violations can include misdemeanor charges.

## 11. USDA, Natural Resource Conservation Service (NRCS)

NRCS was originally established by Congress in 1935 as the Soil Conservation Service, and was charged with addressing "the wastage of soil and moisture resources on farm, grazing, and forest lands." The mission of NRCS has expanded over time to become a conservation leader for all natural resources, ensuring private lands are conserved, restored, and more resilient to environmental challenges, such as climate change. To achieve this goal, NRCS and its predecessor agencies have worked in close partnerships with farmers and ranchers, local and State governments, and Tribes and other Federal agencies to maintain healthy and productive working landscapes.

Seventy percent of the land in the United States is privately owned, making stewardship by private landowners absolutely critical to the health of our Nation's environment. NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and ecosystems. Feral swine damage the resources NRCS is working with partners to protect. In some areas, NRCS receives repeat requests for habitat conservation assistance to repair damage to locations NRCS and its partners had previously worked to conserve and/or restore. NRCS is a participating agency in the preparation of this EIS. This EIS and resulting Record of Decision would not affect the agreements made between the signatory agencies. Responsibilities of signatory agencies, as applicable, are discussed within the EIS as relates to coordination of operations on federal lands, avoidance of conflicts with other land uses, and protecting sensitive resources.

## 12. Memoranda of Understanding

Memoranda of Understanding (MOUs) are used to define general roles and relationships in situations where APHIS is cooperating with agencies and tribes on projects of mutual interest. The MOUs define the type of action of interest, relevant agency authorities, and the responsibilities of each of the participants including responsibility for compliance with federal laws such as the NEPA. MOUs may include procedures for communication and consultation during planning processes and during the implementation of damage management actions. At the National level APHIS and APHIS-WS have four MOUs relevant to feral swine management:

- **MOU between APHIS-WS and the FS.** This agreement documents the cooperation between APHIS-WS and FS to (1) identify responsibilities of the Parties and foster a partnership for the management of indigenous and invasive vertebrates causing damage on FS lands; (2) establishes general guidelines to assist field personnel in carrying out their WDM responsibilities consistent with policies of the FS and APHIS-WS; and (3) to strengthen the cooperative approach to WDM on NFS lands through exchange of information and mutual program support. This MOU specifically mentions feral swine as a species of concern.

- **MOU between APHIS-WS and the BLM**: This MOU (1) establishes general guidelines to assist field personnel in carrying out their wildlife damage management responsibilities; (2) establishes a system for exchange of information and mutual program support; (3) reaffirms working relationships with state governments; (4) identifies responsibilities for NEPA compliance and (5) establishes a partnership for the management of wild vertebrates causing damage on BLM lands in accordance with the authorities and responsibilities of the BLM and APHIS-WS. Feral swine can cause damage on BLM lands and are among the species which could be addressed in accordance with the provisions of this MOU.

- **MOU between APHIS and the FWS:** This MOU was established in accordance with EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds (66 FR 3853). The MOU focuses on avoiding or minimizing adverse impacts on migratory birds and strengthening migratory bird conservation through enhanced collaboration between APHIS and FWS by identify and enhancing areas of cooperation. This agreement includes a framework to guide coordination of efforts to maximize potential benefits to migratory birds from FSDM while minimizing the potential risks from FSDM methods.

- **MOU between APHIS-WS and the National Association of State Aviation Officials, and the U.S. Department of Transportation, Federal Aviation Administration:** The MOU establishes a joint cooperative relationship to reduce the risk of wildlife hazards at airports. As noted in Sections 3.b and 3.c feral swine can be among the animal species posing hazards to aircraft.

In addition to the national-level MOUs, the APHIS-WS program also has MOUs with Tribes, States, local units of Federal agencies (e.g., a specific air force base), and private organizations. Additional MOUs are expected to be developed between APHIS and new partner agencies if an alternative is selected that expands APHIS activities. The MOUs involving APHIS-WS state programs serve similar purposes as the national MOUs but the exact nature and scope of content of the MOUs varies depending upon circumstances and need. For example, MOUs with Tribes reaffirm the special government to government relationship between the Federal government and the Tribes, establish points of contact for the respective parties, and set procedures for communication and consultation.

## I. Public and Tribal Involvement

APHIS published a Notice of Intent and Notice of Scoping on May 13, 2013 (78 FR 92:27937–27939). The public was invited to comment on and provide ideas for the proposed national FSDM program. A public meeting with webcast was held in Riverdale, Maryland on May 23, 2013. The meeting provided information on the proposed plan, and an opportunity for the public to ask questions and provide information for the analysis.

Twenty-five people attended the meeting in person, and people also participated from an additional 121 remote locations. Additional public notification and outreach was provided through notices sent via the APHIS stakeholder registry Web site to APHIS stakeholders, an APHIS Web site on feral swine, and through outreach by cooperating and participating agencies. The APHIS-WS program is also working with Tuskegee University to improve outreach and communications with low-income and minority farmers reached by the 1890's universities' extension programs. APHIS received 62 letters in response to the scoping request. A summary of issues and information from the scoping letter and public meeting is provided on the Feral Swine EIS web site at http://www.aphis.usda.gov/wildlife-damage/fseis.

APHIS is also committed to building strong positive relationships with tribes and including tribes in agency decision-making processes. For Tribal outreach, a Notice of Intent to prepare this EIS, an invitation to attend a May 16, 2013 informational call for Tribes, and an offer to initiate consultation were sent to the leaders of all 565 federally recognized Native American Tribes. The Tribes were also invited to participate in the May 23, 2013 public meeting and Web cast discussed above. At least 15 Tribes and/or Tribal entities participated in the call.[6] Communication and consultation with the Tribes is ongoing. A similar informational call and opportunity to comment will be provided to the tribes for the DEIS.

Tribal outreach has and continues to occur at the state level for all proposed activities, this outreach includes but is not limited to invitations to tribes to participate as a partner agency in the creation of State, Territorial and local environmental analyses that include FSDM and/or consultation with tribes on FSDM. APHIS-WS state personnel also are available to attend meetings and provide technical assistance to tribes on FSDM issues. Additionally, no FSDM actions would be conducted on tribal lands without the express written consent of the tribe. (See also Chapter 4 Section C.10 for a discussion of impacts of FSDM on tribes, traditional cultures, and ceremonial values

[6] The actual number of Tribal representatives participating is an estimate because some participants joined during the call and not all participants identified themselves on the call.

# CHAPTER 2: ALTERNATIVES

## A. Introduction

Chapter 2 contains a detailed description of the alternatives to manage feral swine damage that were selected for detailed evaluation in Chapter 4 of this Environmental Impact Statement (EIS). In its May 13, 2013 scoping notice, APHIS proposed a nationally coordinated FSDM program. The public comments and agency scoping process helped APHIS identify other alternatives to evaluate in detail. Some alternatives and methods that were raised during the scoping process were considered, but are being dismissed from detailed evaluation for reasons discussed in Section G of this chapter. This chapter also includes descriptions of FSDM methods which could be available to APHIS under each of the alternatives, and a list of the Standard Operating Procedures (SOPs) which would be used by APHIS if conducting FSDM to reduce or prevent adverse impacts on the human environment.

## B. Criteria for Alternatives Development

Several criteria were used to help shape the alternatives and develop the range of "reasonable alternatives," as defined by CEQ (1981) for detailed evaluation.

- The alternatives must respond to the purpose and need, specifically the project goal of reducing feral swine damage to agriculture, natural resources, property, animal health, and human health and safety in the United States and its Territories by reducing or eliminating feral swine populations, in cooperation with agency partners, Federal, Tribes, private organizations, and others. Program goals and objectives are specified in Chapter 1, Section G.

- The alternatives must comply with Federal environmental regulations, be legally and environmentally sound, and economically and logistically feasible.

- The alternatives must be programmatic in nature to accommodate national level coordination.

- The alternatives must be flexible enough to facilitate collaboration with agency partners and other cooperators, and accommodate the high levels of variation found among State, Tribal, Territorial and local laws, management objectives, feral swine presence, environmental conditions, or variations in funding levels. The alternatives must work within existing agency partner and Tribal regulatory regimes, or adapt to regulatory changes.

## C. Adaptive Management and the APHIS-WS Decision Model

APHIS-WS personnel use an adaptive management thought process for evaluating and responding to damage complaints that is depicted by the APHIS-WS Decision Model described by Slate et al. (1992; Figure 2-1; WS Directive 2.201[7]). The Decision Model is not a written documented process, but a mental problem-solving process similar to adaptive management strategies used by all wildlife management professionals, including those in the lead and cooperating agencies for this EIS when addressing a wildlife damage problem. APHIS-WS personnel assess the problem, and evaluate the appropriateness and availability (legal and administrative) of damage management strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted, and evaluation continues to assess the effectiveness of the strategy. Management strategies are then adjusted, modified, or discontinued, depending on the results of the evaluation.

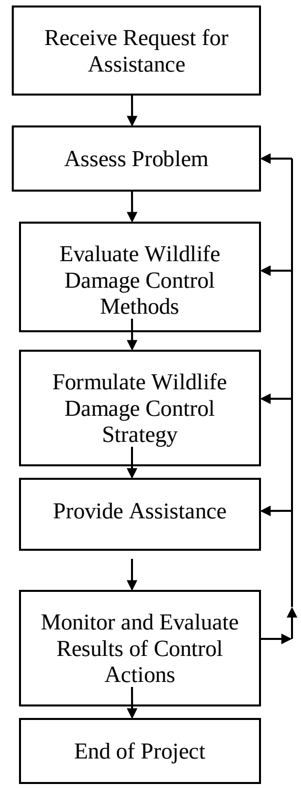


**Figure 2-1**. APHIS-WS Decision Model

The APHIS-WS program applies an Integrated Wildlife Damage Management (IWDM) approach to reduce wildlife damage (APHIS-WS Directive 2.105). As used and recommended by the APHIS-WS program, IWDM encompasses the integrated application of approved methods simultaneously or sequentially as appropriate to reduce or prevent wildlife damage. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, elimination of invasive species (e.g., feral hogs) or any combination of these, depending on the circumstances of the specific damage problem.

## D. Description of Alternatives

This section contains descriptions of the alternatives that were developed for detailed analysis in Chapter 4. The alternatives are summarized in table format in Section E. The specific management methods that could be available for use under the alternatives are described in Section F.

[7] The APHIS-WS Program Directives can be accessed from the APHIS-WS home web page at http://www.aphis.usda.gov/wildlifedamage

## 1. Alternative 1—Current APHIS Feral Swine Damage Management Program (Current APHIS FSDM Program (No Action Alternative))

The Current APHIS FSDM Program, the No Action Alternative, is a procedural NEPA requirement (40 CFR 1502) and serves as a starting point for comparison with the other alternatives. The No Action Alternative can be defined as "no change" from the status quo, which is the continuation of the Current APHIS FSDM Program activities. Using the Current APHIS FSDM Program (Alternative 1) as the No Action Alternative is consistent with the President's Council on Environmental Quality definition for No Action Alternative (CEQ 1981).

Congress has acknowledged that feral swine are a harmful and destr-uctive species, and that a federal response to feral swine damage is warranted (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2014, Public Law No. 113-76 2014). The Fiscal Year[8] 2014 (FY14) USDA budget allocates $20 million to APHIS to implement FSDM. Consequently, some sort of increased federal FSDM program will be implemented (e.g., Alternatives 2-5), and this No Action Alternative cannot be selected for implementation unless Congress determines that a FSDM Program is no longer a priority. This No Action Alternative serves as a baseline for comparison in the environmental analysis.

The Current APHIS FSDM Program, the No Action Alternative, includes the following general components:

### *a. Collaboration and Project Identification*

APHIS-WS State program leaders, usually APHIS-WS State Directors, enter into cooperative partnerships in all aspects of operational FSDM when requested by agency partners, Tribes, and private entities. These FSDM projects are initiated and funded by partner agencies, Tribes, and other cooperators who have experienced feral swine damage or are working on research pertaining to feral swine. Cooperative partnerships may be developed to implement FSDM in targeted agricultural areas, areas with T&E species and other natural resources, urban/suburban areas to reduce property damage or other locations to address specific FSDM needs (e.g., protection of human health and safety).

### *b. Operations*

Under this Alternative, the status quo for APHIS-WS FSDM activities is an IWDM approach, as described in Section 2.C, that incorporates the use or recommendation of a range of nonlethal and lethal techniques, used singly or in combination, to meet the need of each requestor for resolving conflicts with feral swine. APHIS-WS State programs provide assistance to cooperators in the form

[8] USDA Fiscal Year (FY) runs from Oct 1 to Sept 30.

of technical assistance (advice, training, loan of equipment). When appropriate, APHIS-WS also provides damage management assistance (operational assistance) using lethal and non-lethal methods, if funding is available. Resource managers and others requesting operational assistance are provided with information regarding the use of effective nonlethal and lethal techniques including recommendations as to effective long-term strategies for reducing risk of feral swine damage. Lethal methods used by APHIS-WS includes shooting, aerial shooting, snaring, and live trapping (snares, nets, cage traps, and less commonly, foothold traps), followed by euthanasia. Euthanasia is not feasible under all field conditions. However, APHIS-WS employees strive to incorporate American Veterinary Medical Association (AVMA 2013) euthanasia recommendations for free-roaming animals in program activities, where practical and effective. Where they are not practical or effective, the animal is dispatched as quickly and humanely as possible. Non-lethal methods used or recommended by APHIS-WS may include fencing and aversive devices. In many situations, the implementation of non-lethal methods (i.e., fencing) would be the responsibility of the requestor to implement. A reproductive control agent or toxicant may be incorporated into program activities if/when it is registered for use. Toxicants and other reproductive control methods such as sodium nitrite and phage-peptide constructs are under development. These methods could be used if proven effective and registered for use with EPA after the completion of environmental review as directed by the NEPA. (A complete list and description of FSDM methods available to APHIS-WS is provided in Section E of this chapter.)

The Current APHIS FSDM Program is or may be conducted on private, public, Tribal, and other lands where a request has been made, a need has been documented, and after appropriate agreements for service have been prepared. All management actions comply with appropriate Federal, State, Territorial, Tribal, and local laws.

### *c. Disease Monitoring*

APHIS-WS personnel collect biological samples from some feral swine killed during operational control activities and from other sources (e.g., hunter-killed animals in some States). APHIS-WS submits samples to labs identified by APHIS-VS to run diagnostic tests. Over 2,300 feral swine were sampled each year during previous years to monitor for classical swine fever in the United States. Samples from those same 2,300 feral swine samples have also been used to monitor for pseudorabies, swine brucellosis, and other diseases of national interest.

### *d. Research*

The APHIS-WS National Wildlife Research Center (NWRC) currently conducts research projects on an array of issues related to feral swine, including:

- Toxicants and delivery systems to control feral swine;
- Patterns of feral swine movement and potential disease transfer between feral swine, domestic animals, and wildlife;
- Effectiveness of various feral swine exclusion devices;
- Effectiveness of capture devices;
- Population estimation techniques;
- Baits for pharmaceutical delivery;
- Attractants for feral swine;
- Fertility control agents (e.g., GonaCon™);
- Feral swine behaviors in response to damage control activities;
- Economic analysis of feral swine damage;
- Economic considerations for implementing management strategies; and
- Ecological investigations addressing feral swine impacts on agriculture and the environment.

Currently, research is constrained due to limited funding and it is necessary to prioritize projects. The highest NWRC feral swine research priority is assessing the feasibility of sodium nitrite, a feral swine toxicant developed in Australia, to safely reduce feral swine populations. Another related high-priority study focuses on developing a delivery system to dispense baits to feral swine while limiting access to non-target species. NWRC regularly collaborates with other government agencies, universities, and private organizations to conduct research activities.

### *e. Outreach and Education*

Most APHIS outreach and education efforts are conducted by personnel at the State and Territory level. APHIS personnel provide on-site technical assistance, participate in professional and public meetings, fairs and other gatherings, and teach classes on wildlife damage management (including management of invasive species) as time, cooperative agreements, and available funding allow. A number of agencies, universities, and private entities also provide education and outreach on FSDM, and APHIS may work collaboratively on projects with these entities. Some educational materials have been developed by APHIS at the national level. However, in the absence of dedicated FSDM funding, APHIS must balance FSDM outreach and education needs with the needs of all other APHIS programs and projects.

#### *f. Disposal of Feral Swine Removed During Damage Management Activities*

Feral swine carcasses are disposed in a manner that comports with APHIS-WS Directive 2.515, Disposal of Wildlife Carcasses, which states that all disposals will be made in a manner that is consistent with Federal, State, Tribal, Territorial, and local regulations. Discussion of carcass disposal methods is provided in Section E. 11.

### 2. Alternative 2 - Integrated Feral Swine Damage Management Program (Integrated FSDM Program/Preferred Alternative)

#### *a. Introduction*

The Integrated FSDM Program (Alternative 2) is the management alternative preferred by APHIS. It is a nationally coordinated response that integrates improvements to the baseline operational capacity of APHIS-WS in all states with feral swine, strategically allocates resources to reducing the size and range of the national feral swine population and protecting select local resources (see "Strategic Local Projects" in section b. below). It also provides improved national support for research, education, disease monitoring and international coordination. APHIS would serve as the lead Federal agency in a cooperative effort with other agency partners, Tribes, organizations, and local entities that share a common interest in reducing or eliminating problems caused by feral swine.

APHIS' strategy would be to provide resources, expertise, and overall coordination at the national level, while allowing APHIS-WS State Directors the local decision-making authority and flexibility to provide FSDM operational services in cooperation with local partners. APHIS-WS State programs would have the flexibility needed to effectively manage operational activities based on local needs and constraints. Flexibility is necessary considering the wide variation among State laws governing feral swine management, and local environmental conditions that must be considered in site-specific planning (e.g., land uses, access, vegetative cover, terrain, weather, and feral swine populations). APHIS' capacity to manage feral swine damage and risks to human and animal health will continue to be enhanced through cooperation with agency partners, Tribes, and local entities, with a common interest in eliminating problems caused by feral swine. A Draft version of a national fsdm program plan with specific details on how the project may be implemented if Alternative 2 is selected is provided for reference on the Feral Swine EIS webpage http://www.aphis.usda.gov/wildlife-damage/fseis.

APHIS would implement activities to reduce problems associated with feral swine in most States where they are present. In States where feral swine are emerging, or populations are low, APHIS would cooperate with partner agencies to implement strategies to eliminate them. In States where feral swine populations are large and widely distributed, and/or State, Territorial, or Tribal management objectives do not support eradication, APHIS and its partners would protect local resources and reduce problems by suppressing local populations and implementing other local risk and damage management measures.

***b. Key Program Components***

Improve Baseline Operational Capacity to Respond (Infrastructure)

As noted, under the Current Program Alternative (Alternative 1), APHIS-WS response capacity has been limited to actions which can be conducted with cooperator funding and very limited APHIS resources. Under the Integrated FSDM Program Alternative, additional funding and resources would be distributed to APHIS-WS State programs to enhance baseline operational capacity to respond to requests for assistance with feral swine damage and increase cost-share partnerships with other agency, Tribal, and private partners to address local FSDM problems. Allocation of APHIS personnel, funding, and other resources would be coordinated through APHIS-WS State Programs in consultation with agency partners, Tribes, and other organizations. The level of funding allocated to each State WS program office would depend on feral swine populations and distributions, damage to resources, presence of potential resources likely to be damaged, and State, Territorial, or local regulations that impact management efforts in the States and Territories served by the office.

In States and Territories with small isolated populations or scattered reports of feral swine, APHIS-WS would be expected to investigate and confirm reports of feral swine activity by conducting ground or aerial surveys to locate feral swine or evidence of damage, and remove them as appropriate, in collaboration with State, Territorial and Tribal officials. By enhancing baseline capacity, APHIS-WS would be better positioned to conduct these activities and be able to remove swine from some areas while their populations are still relatively small. Most of APHIS-WS' prior FSDM actions (under the Current Program Alternative) have been conducted at the request of individual cooperators (land management agencies for individual properties and private entities). Cooperator resources and prioritization of FSDM varies. This variation limits APHIS' capacity to detect and affect overall feral swine populations affecting multiple adjacent landowners/managers and managing entities. Additionally, cooperators typically have not requested APHIS-WS assistance until after feral swine populations were large or damage became extensive. By enhancing baseline operational capacity with appropriated funds, APHIS-WS would be able to proactively address damage issues before they become difficult and expensive to manage.

National Feral Swine Damage Management Projects

National projects would be implemented to enable comprehensive coverage of disease monitoring, risk analysis, and economic analysis, along with other research activities on feral swine including but not limited to research on new FSDM and population monitoring methods and population modeling. National projects would provide additional support for activities to meet the national objective of preventing the spread of feral swine, and eventually reducing the range and population size of feral swine in the United States and its Territories. APHIS would focus its initial efforts on eliminating feral swine from States with emerging or low populations (i.e., feral swine present and breeding in small numbers and/or limited to isolated portions of the State) (see Figure 2-2). Once feral swine are removed from States with low feral swine populations, resources dedicated for population removal would be shifted to other areas, leaving a minimal baseline capacity in these States to ensure feral swine populations do not become re-established. Additional criteria considered when prioritizing states would include project duration, potential for long-term impacts, costs, and State laws/regulations that may affect success. This Alternative would also provide funds to aid in investigation of feral swine sightings in states where feral swine are not currently known to occur.

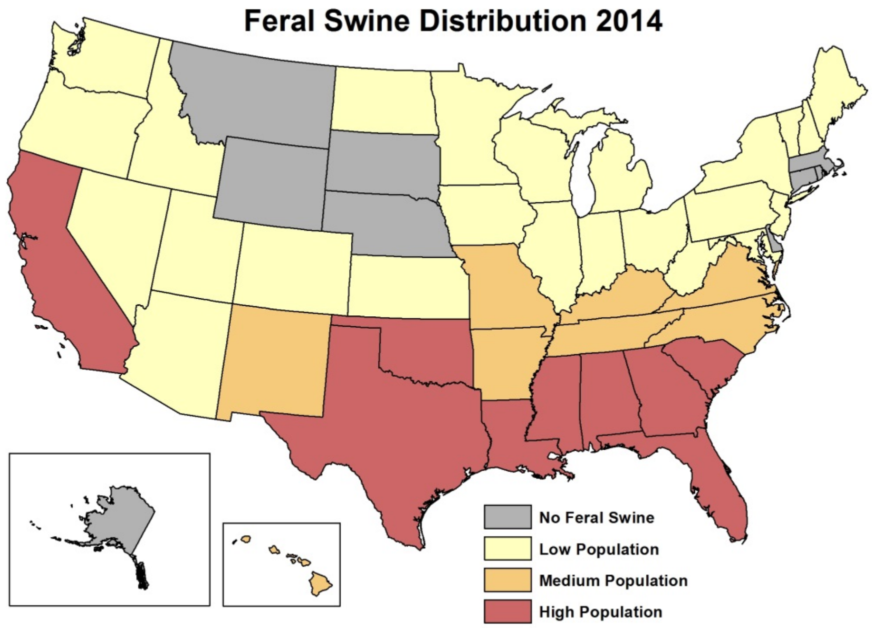


**Figure 2-2.** Distribution of feral swine in 2014. States with low populations generally have <10,000 feral swine and swine are only in isolated portions of a State; States with medium populations generally have 10,000–100,000 feral swine; and States with high populations generally have >100,000 feral swine and feral swine are found in all or most counties in the State. Population estimates provided by APHIS-WS state program directors in collaboration with State agency partners.

Strategic Local Projects

Strategic local projects would be developed and proposed by APHIS-WS' State Directors in conjunction with partner agency, Tribal, and other local partners to address specific feral swine issues within their respective States. These projects would support national objectives, but generally on a smaller or more local scale. Priorities for strategic local projects would include geographic importance (i.e., isolation from other populations), resources protected, results support achieving national goals/objectives, potential for success, available cost-share funds from non-APHIS source, and potential for long-term impacts (e.g., population elimination/ reduction). For example, this could include projects designed to eliminate feral swine populations in specified areas (e.g., county level, refuges) within a State, enable collaborative opportunities to work with local stakeholders to address feral swine issues, or provide increased protection of particularly vulnerable or valuable local resources (e.g., commercial swine facilities, T&E species).

Generate Cooperative Support

APHIS would seek cooperative partners in all aspects of FSDM. APHIS would develop projects with cooperators to combine efforts and resources towards meeting national objectives. Often, the APHIS lead for these projects would be APHIS-WS State Directors. These activities will usually focus on eliminating or suppressing feral swine populations in targeted agricultural areas, protecting natural and cultural resources, or removing swine from urban/suburban areas to reduce property damage.

### *c. Similarity with Current APHIS FSDM Program (Alternative 1, No Action Alternative)*

Operations

The Integrated FSDM Program Alternative would incorporate most aspects of the Current APHIS FSDM Program Alternative (i.e., the No Action Alternative) including: 1) the use of the Decision Model (Slate et al. 1992, Figure 2-1, Section **F**) for determining the most appropriate field-level management strategies; 2) all available management methods including technical assistance, lethal tools, and non-lethal methods (Section E); and 3) all applicable APHIS-WS Standard Operating Procedures (SOPs) (Section G). APHIS-WS would continue to use an IWDM approach to resolve damage issues.

Disease Monitoring

APHIS-WS State programs would continue to opportunistically collect disease samples, under the Integrated FSDM Program Alternative. However, this alternative allows for targeted sampling where disease transmission risk might be highest.

Research

NWRC would continue existing research projects and collaborative efforts described under the No Action Alternative (Current APHIS FSDM Program). NWRC would continue to work with agency partners and research institutions to develop or modify other new capture devices, and to evaluate efficacy and efficiency of existing and new methods, including potential reproductive inhibiters (e.g., GonaCon™). However, there would be better coordination between research and the needs of the operational implementation of the program.

Education

APHIS would continue to provide on-site technical assistance, teach classes, publish research findings, and participate in professional and public meetings, fairs and other gatherings where people may be interested in FSDM (e.g., an educational booth at a state fair). APHIS would also continue to collaborate with other entities on feral swine outreach and education materials and projects.

Carcass Disposal

APHIS would continue to dispose of carcasses in accordance with APHIS-WS Directive 2.515, Disposal of Wildlife Carcasses and applicable Federal, State, Tribal, Territorial, and local regulations.

### *d. Unique Aspects of Alternative 2, Integrated FSDM Program*

New components of the National fsdm Program under Alternative 2 that are different from the No Action Alternative are as follows:

Operations

Under the Preferred Alternative, APHIS-WS would increase its capacity to deliver FSDM assistance at the State level because WS would receive additional federal funding for FSDM. Field operations would primarily consist of efforts to reduce feral swine populations, in specific areas, to protect valuable resources. APHIS-WS State Directors would lead field operations and would serve as the primary liaison with agency partners, Tribes and other cooperators. APHIS-WS would continue to use an IWDM approach to resolve damage issues. Aerial shooting has proven to be an effective means to control feral swine, and would be expected to increase under the Preferred Alternative. The operational APHIS-WS programs would have increased capacity to respond to requests to provide education, technical advice, and recommendations to landowners, when requested. Additionally, national level outreach and education efforts would increase.

Disease and Population Monitoring

Unlike the current program, which primarily uses opportunistic sampling for disease monitoring, this alternative would include increased targeted disease monitoring that uses strategic and scientifically sound sampling designs. APHIS would collaborate with agency partners to identify locations where disease transmission is of greatest concern due to potential for interaction between feral swine and livestock or wildlife, and then would target monitoring efforts at those locations. As data and tools become available, risk-based modeling will be used to aid identification of locations and populations that should be targeted for disease sampling. APHIS-VS identified five diseases to be incorporated in a national surveillance program: classical swine fever, swine brucellosis, porcine reproductive and respiratory syndrome, influenza A virus in swine (IAV-S), and pseudorabies. However, the list of diseases included in monitoring efforts could be modified to address needs as they develop. (e.g., Porcine Epidemic Diarrhea Virus) including diseases that may impact native wildlife populations. APHIS-VS also would provide general guidance and support for diagnostic tests conducted through the National Veterinary Services Laboratories and collaborating laboratories. Beyond the five diseases included in the national monitoring program, APHIS would collect additional biological samples from feral swine in collaboration with State, Territorial, Tribal and local animal health officials to address concerns regarding diseases in their area. APHIS would also collect samples to support research activities to assess new disease risks.

APHIS would also work with the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention to provide assistance for monitoring diseases of concern to public health. These partnerships would enable APHIS and human health institutions to improve risk mitigation for zoonotic pathogens, such as pathogenic *E. coli*, leptospirosis, and Salmonella. These efforts directly support APHIS' efforts to address zoonotic diseases in animals, and Health and Human Services' goal to advance the health, safety, and well-being of the American people by reducing the occurrence of infectious diseases.

Research

Under the preferred alternative, additional funding would be available for research on FSDM. This would enable NWRC to work on more projects concurrently than under the Current APHIS FSDM Program (Alternative 1 – No Action Alternative). NWRC would have improved capacity to form partnerships with agencies, tribes and research institutions to investigate potential for emerging technologies to be incorporated in feral swine control and monitoring activities (e.g., reproductive inhibitors such as phage-peptide constructs).

Another role of research would be developing and evaluating performance measurements for monitoring accomplishments of the FSDM program including improved techniques to estimate feral swine populations and monitor population trends. APHIS-WS and APHIS-PPD would work closely to develop performance measurements that are consistent with long-term strategic goals and objectives of the National fsdm Program. Performance measures would be incorporated into adaptive management decision making.

APHIS-VS also would contribute to feral swine research. The APHIS-VS Center for Epidemiology and Animal Health (CEAH) would integrate existing knowledge to develop disease risk models to estimate potential impacts of feral swine on domestic agriculture animals. Epidemiologic data gathered during disease surveillance activities would also be of value in populating risk models. These models would be used in developing and evaluating future strategies for monitoring feral swine diseases and FSDM activities. CEAH would collaborate with APHIS-WS to refine existing maps of feral swine distribution, and create habitat models to predict where future feral swine establishment may occur. APHIS-VS' Wildlife Livestock Disease Investigations Team would also investigate technologies for remote detection of infectious diseases in feral swine (e.g., brucellosis, tuberculosis). They also would aid in the development and evaluation of population and disease management methods for feral swine, such as vaccines and vaccine delivery methods.

Education and Outreach

National level communication support will be available including but not limited to the development of a strategic communication plan, key messages, and related outreach materials and events. APHIS will work with agency partners, Tribes and private entities to identify appropriate audiences, messages, materials, and actions/events. Initial materials development will likely focus on web pages, factsheets, displays, and online videos. National level assistance will be available to APHIS program spokespeople in the States and Territories when responding to media inquiries, and identifying and coordinating proactive media opportunities.

Disposal of Swine

The number of feral swine removed by APHIS-WS would substantially increase under this alternative. In addition to conformance with applicable APHIS program policy for carcass disposal, as described under Sections G (Standard Operating Procedures) and E.11. (different disposal methods), the APHIS-WS Feral Swine Program Manager would work with appropriate APHIS-VS personnel and agency and Tribal partners to review current carcass disposal guidelines, and develop or refine additional guidelines and methods. All disposals would be made in a manner that demonstrates APHIS-WS' recognition of the public's sensitivity to the viewing of animal carcasses. APHIS-WS would work with agency partners and Tribes to ensure that feral swine carcass disposal is conducted in compliance with the Endangered Species Act, the Clean Water Act, and similar applicable State, Territorial, Tribal, and local government statutes.

Regulatory Actions

The lead and cooperating federal agencies have limited regulatory authority for feral swine management. Under the Integrated FSDM Program (Alternative 2), APHIS does not propose to modify its existing regulations at 9 CFR 78.30(c) which restrict the interstate transportation of animals. APHIS would continue to assess the effectiveness of these regulations, and would also work with Federal agency partners to investigate other regulatory options under their authorities. These efforts could aid in reducing feral swine damage and help prevent illegal movement of swine. (See also Section F.2.b. below.)

States, Territories, Tribes, and local governments are the primary entities with regulatory authority pertaining to feral swine hunting, animal production practices, and the sale and movement of animals in their jurisdiction. APHIS would work with agency and Tribal partners on ideas to improve the consistency and efficacy of State, Territorial, Tribal, and local regulations and policies to address FSDM. APHIS would also work with Federal, State, Territorial, Tribal and local partners on education and outreach efforts pertaining to feral swine regulations, and the need for feral swine management. (See also Section F.2.b below.)

Coordination with Neighboring Countries

Feral swine are known to move across borders between the United States and Mexico and Canada on their own and through human intervention. The Integrated FSDM Program (Alternative 2) would address issues associated with feral swine along these borders. APHIS- VS, -WS and -IS would work collaboratively with Mexico and Canada to develop plans to reduce movement of feral swine and associated damage and disease risks.

Evaluation and Monitoring

APHIS would monitor program adherence to conditions specified in the EIS, Record of Decision (ROD) including any required mitigation for compliance with relevant laws, regulations and program policies. APHIS would also develop performance measurements that are consistent with long-term strategic goals and objectives of the FSDM plan. Program monitoring and performance reports would be used to communicate with agency decision-makers and budget officials within USDA and APHIS and to guide and refine management practices in accordance with adaptive management practices.

### 3. Alternative 3—Baseline APHIS FSDM Program

#### *a. Introduction*

The Baseline APHIS FSDM Program (Alternative 3) is a nationally coordinated response that improves the baseline operational capacity of APHIS-WS state programs that assist in states and territories and Tribal lands with feral swine. This alternative does not include the national feral swine projects or strategic local projects as described for the Integrated FSDM Program (Alternative 2). Allocations would be based on the size of the feral swine population in each state and territory. Resources would not be strategically allocated at the national level specifically to stabilize and eventually reduce the national feral swine population, although some population reductions and eliminations would be likely as a result of improved baseline operational capacity at the State, Territory and Tribal level. As with the Integrated FSDM Program (Alternative 2), APHIS would serve as the lead Federal agency in a cooperative effort with other agency partners, Tribes, organizations, and local entities that share a common interest in reducing or eliminating problems caused by feral swine.

### *b. Key Program Components*

Improve Baseline Operational Capacity to Respond (Infrastructure)

This alternative would increase the resources available for APHIS-WS state programs to conduct FSDM at the State, Territory, and Tribal level. The Baseline FSDM Program would maximize cost-share opportunities for operational management with agency partners, Tribes, and other cooperators because the majority of available funds would be directed to local feral swine management, instead of being partially allocated to national projects such as research, educational programs, international coordination, and disease monitoring.

APHIS would provide resources at the national level while allowing APHIS-WS State Directors the local decision-making authority and flexibility to provide FSDM operational services in cooperation with local partners. As with the Integrated FSDM Program (Alternative 2), APHIS-WS State programs would have the flexibility needed to effectively manage operational activities based on local needs and constraints. APHIS' capacity to manage feral swine damage and risks to human and animal health will continue to be enhanced through cooperation with agency partners, Tribes, and local entities, with a common interest in eliminating problems caused by feral swine. In States where feral swine are emerging, or populations are low, APHIS would cooperate with partner agencies to implement strategies to eliminate them. In States where feral swine populations are large and widely distributed, and/or State, Territorial, or Tribal management objectives do not support eradication, APHIS and its partners would protect local resources and reduce problems by suppressing local populations and implementing other local risk and damage management measures.

Generate Cooperative Support

APHIS would seek cooperative partners in all aspects of FSDM. APHIS would develop projects with cooperators to combine efforts and resources towards meeting national objectives. Often, the APHIS lead for these projects would be APHIS-WS State Directors. These activities will usually focus on eliminating or suppressing feral swine populations in targeted agricultural areas, protecting natural and cultural resources, or removing swine from urban/suburban areas to reduce property damage and risks to public safety.

### *c. Similarity with Current APHIS FSDM Program (Alternative 1, No Action Alternative)*

Operations

The Integrated FSDM Program Alternative would incorporate most aspects of the Current APHIS FSDM Program Alternative (i.e., the No Action Alternative) including: 1) the use of the Decision Model (Slate et al. 1992, Figure 2-1, Section F) for determining the most appropriate field-level management strategies; 2) all available management methods including technical assistance, lethal tools, and non-lethal methods (Section E); and 3) all applicable APHIS-WS Standard Operating Procedures (SOPs) (Section G). APHIS-WS would continue to use an IWDM approach to resolve damage issues.

<u>Disease Monitoring, Research</u>

There would be no increases in most national program activities including disease monitoring, research, outreach and education, and international coordination. These activities would occur at levels described for the Current APHIS FSDM Program (Alternative 1) above.

<u>Carcass Disposal</u>

APHIS would continue to dispose of carcasses in accordance with APHIS-WS Directive 2.515, Disposal of Wildlife Carcasses and applicable Federal, State, Tribal, Territorial, and local regulations.

***d. Unique Aspects of Alternative 3, Baseline APHIS FSDM Program***

New components of the Baseline FSDM Program that are different from the No Action Alternative are as follows:

<u>Operations</u>

This alternative would increase APHIS-WS' operational baseline FSDM capacity to respond over levels which would occur under the Current APHIS FSDM Program (Alternative 1) and Integrated FSDM Program (Alternative 2) for WS state programs working in States, Territories and Tribal lands with feral swine. Aerial shooting has proven to be an effective means to control feral swine, and would be expected to increase under this alternative, because the increase in federal resources would facilitate access to trained aerial shooting equipment and personnel.

Disposal of Swine

The number of feral swine removed by APHIS-WS would substantially increase under this alternative. In addition to conformance with applicable APHIS program policy for carcass disposal, as described under Sections G (Standard Operating Procedures) and E.11. (different disposal methods), the APHIS-WS Feral Swine Program Manager would work with appropriate APHIS-VS personnel and agency and Tribal partners to review current carcass disposal guidelines, and develop or refine additional guidelines and methods.

Regulatory Actions

States, Territories, Tribes, and local governments are the primary entities with regulatory authority pertaining to feral swine hunting, animal production practices, and the sale and movement of animals within their area of jurisdiction. APHIS would work with agency and Tribal partners at the State, Territory, Tribal and local level on ideas to improve the efficacy of their regulations and policies to address FSDM and on education and outreach efforts pertaining to feral swine regulations, and the need for feral swine. However, these efforts would primarily occur at the state, territory and tribal level. There would be no change in national level review of regulatory processes under this alternative over that which occurs under the Current FSDM Program (Alternative 1).

Education and Outreach

The APHIS-WS state programs would have increased capacity to respond to requests to provide education, technical advice, and recommendations to landowners because of the increase in baseline operational capacity to respond. However, these efforts would not have the benefit of support from a national FSDM education and outreach program as would occur under the Integrated FSDM Program (Alternative 2) and National FSDM and Strategic Local Projects Program (Alternative 4).

Evaluation and Monitoring

Program evaluation and monitoring would occur as under the Integrated FSDM Program (Alternative 2). However, the evaluation and monitoring process would not benefit from research in the same way as the Integrated FSDM Program because there would be no increase in NWRC research capacity under this alternative.

APHIS would monitor program adherence to conditions specified in the EIS, Record of Decision (ROD) including any required mitigation for compliance with relevant laws, regulations and program policies. APHIS would also develop performance measurements that are consistent with long-term strategic goals and objectives of the FSDM plan. Program monitoring and performance reports would be used to communicate with agency decision-makers and budget officials within USDA and APHIS and to guide and refine management practices in accordance with adaptive management practices.

## 4. Alternative 4—National FSDM and Strategic Local Projects Program

### *a. Introduction*

This alternative places emphasis on national FSDM projects and strategic local projects as described in Section 2.b. above. This alternative would focus all available resources on national and strategic local projects selected based on their ability to help achieve national goals of containing and eradicating feral swine and protection of sensitive resources (e.g., cultural sites, Threatened and Endangered species). Consequently, APHIS-WS programs serving States and Territories which are a low priority for achieving national feral swine population management objectives may not receive any federal funding to enhance FSDM efforts until management objectives are achieved in high priority areas and resources reallocated to new sites. APHIS-WS programs in low priority States and Territories could continue to assist cooperators as currently occurs under Alternative 1.

### *b. Key Program Components*

<u>National Feral Swine Damage Management Projects</u>

National FSDM projects under this alternative would be the same as for the Integrated FSDM Program. However, resources that would go to improve baseline capacity to respond in low priority States and Territories under Alternative 2 would be allocated to national and strategic local operations projects under this alternative. APHIS would focus its initial efforts on eliminating feral swine from States with emerging or low populations (i.e., feral swine present and breeding in small numbers and/or limited to isolated portions of the State) (see Figure 2-2). Once feral swine are removed from States with low feral swine populations, resources dedicated for population removal would be shifted to other areas, leaving a minimal baseline capacity in these States to ensure feral swine populations do not become re-established. Additional criteria considered when prioritizing states would include project duration, potential for long-term impacts, prior status, costs, and State laws/regulations that may affect success. This alternative would also provide funds to aid in investigation of feral swine sightings in states where feral swine are not currently known to occur. Program objectives include eliminating feral swine from 2 States in the first 5 years; continuing to eliminate feral swine from additional states, on average eliminating feral swine from 2 states every 5 years; and stabilizing the increase in feral swine damage within 10 years of program initiation.

Strategic Local Projects

Strategic local projects would be developed and proposed by APHIS-WS' State Directors in conjunction with partner agency, Tribal, and other local partners to address specific feral swine issues within their respective States. These projects would support national objectives, but generally on a smaller or more local scale. Priorities for strategic local projects would include geographic importance (i.e., isolation from other populations), resources protected, results support achieving national goals/objectives, potential for success, available cost-share funds from non-APHIS source, and potential for long-term impacts (e.g., population elimination/ reduction). For example, this could include projects designed to eliminate feral swine populations in specified areas (e.g., county level, refuges) within a State, enable collaborative opportunities to work with local stakeholders to address feral swine issues, or provide increased protection of particularly vulnerable or valuable local resources (e.g., commercial swine facilities, T&E species).

Generate Cooperative Support

APHIS would seek cooperative partners in all aspects of FSDM. APHIS would develop projects with cooperators to combine efforts and resources towards meeting national objectives. Often, the APHIS lead for these projects would be APHIS-WS State Directors. These activities will usually focus on eliminating or suppressing feral swine populations in targeted agricultural areas, protecting natural and cultural resources, or removing swine from urban/suburban areas to reduce property damage and risks to public safety.

***c. Similarity with Current APHIS FSDM Program (Alternative 1, No Action Alternative)***

Operations

The Integrated FSDM Program Alternative would incorporate most aspects of the Current APHIS FSDM Program Alternative (i.e., the No Action Alternative) including: 1) the use of the Decision Model (Slate et al. 1992, Figure 2-1, Section F) for determining the most appropriate field-level management strategies; 2) all available management methods including technical assistance, lethal tools, and non-lethal methods (Section E); and 3) all applicable APHIS-WS Standard Operating Procedures (SOPs) (Section G). APHIS-WS would continue to use an IWDM approach to resolve damage issues.

Some APHIS-WS' programs in States, Territories and Tribes with large feral swine programs, or in areas where eradication is not feasible or desired (e.g., feral swine managed as a game species) may not receive any funding until such time as priority management objectives have been achieved and resources are shifted to other areas with feral swine. In these areas, APHIS involvement in FSDM would be the same as occurs under the Current FSDM Program.

Disease Monitoring

APHIS-WS State programs would continue to opportunistically collect disease samples, under the Current FSDM Program (Alternative 1). However, this alternative also allows for targeted sampling where disease transmission risk might be highest. In states which are not identified as a priority for National FSDM project, targeted disease surveillance could be funded as a strategic local project.

Research

NWRC would continue existing research projects and collaborative efforts described under the No Action Alternative (Current APHIS FSDM Program). NWRC would continue to work with agency partners and research institutions to develop or modify other new capture devices, and to evaluate efficacy and efficiency of existing and new methods, including potential reproductive inhibiters (e.g., GonaCon™). However, there would be better coordination between research and the needs of the operational implementation of the program.

Education

APHIS would continue to provide on-site technical assistance, teach classes, publish research findings, and participate in professional and public meetings, fairs and other gatherings where people may be interested in FSDM (e.g., an educational booth at a state fair). APHIS would also continue to collaborate with other entities on feral swine outreach and education materials and projects.

Carcass Disposal

APHIS would continue to dispose of carcasses in accordance with APHIS-WS Directive 2.515, Disposal of Wildlife Carcasses and applicable Federal, State, Tribal, Territorial, and local regulations.

***d. Unique Aspects of Alternative 3, National FSDM and Strategic Local Projects Program***

New components of the National fsdm Program under Alternative 4 that are different from the No Action Alternative are as follows:

Operations

Under the Preferred Alternative, APHIS-WS would increase its capacity to deliver FSDM assistance in States, Territories and Tribal lands that are identified as national FSDM priorities. Field operations in strategic local project areas would primarily consist of efforts to reduce feral swine populations, in specific areas, to protect valuable resources. APHIS-WS State Directors would lead field operations and would serve as the primary liaison with agency partners, Tribes and other cooperators. APHIS-WS would continue to use an IWDM approach to resolve damage issues. Aerial shooting has proven to be an effective means to control feral swine, and would be expected to increase under this alternative. The APHIS-WS programs serving priority states and territories would have increased capacity to respond to requests to provide education, technical advice, and recommendations to landowners, when requested.

Disease and Population Monitoring

Unlike the current program, which primarily uses opportunistic sampling for disease monitoring, this alternative would include increased targeted disease monitoring that uses strategic and scientifically sound sampling designs. APHIS would collaborate with agency partners to identify locations where disease transmission is of greatest concern due to potential for interaction between feral swine and livestock or wildlife, and then would target monitoring efforts at those locations. As data and tools become available, risk-based modeling will be used to aid identification of locations and populations that should be targeted for disease sampling. Identification of priority diseases for the national surveillance program would be the same as described for the Integrated FSDM Program (Alternative 2). APHIS-VS also would provide increased guidance and support for diagnostic tests conducted through the National Veterinary Services Laboratories and collaborating laboratories. APHIS would also collect additional biological samples from feral swine in collaboration with State, Territorial, Tribal and local animal health officials to address concerns regarding diseases in their area. APHIS would also collect samples to support research activities to assess new disease risks.

APHIS capacity to cooperate with the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention to provide assistance for monitoring diseases of concern to public health would increase under this alternative in the same manner as described for the Integrated FSDM Program (Alternative 2).

Research

Under the preferred alternative, additional funding would be available for research on FSDM. This would enable NWRC to work on more projects concurrently than under the Current APHIS FSDM Program (Alternative 1 – No

Action Alternative) and Baseline FSDM Program (Alternative 3). NWRC would have increased capacity to form partnerships with agencies, tribes and research institutions to investigate potential for emerging technologies to be incorporated in feral swine control and monitoring activities (e.g., reproductive inhibitors such as phaged-peptide constructs).

As with the Integrated FSDM Program (Alternative 2), the APHIS-VS Center for Epidemiology and Animal Health (CEAH) would integrate existing knowledge to develop disease risk models to estimate potential impacts of feral swine on domestic agriculture animals. CEAH would collaborate with APHIS-WS to refine existing maps of feral swine distribution, and create habitat models to predict where future feral swine establishment may occur. APHIS-VS' Wildlife Livestock Disease Investigations Team would also investigate technologies for remote detection of infectious diseases in feral swine (e.g., brucellosis, tuberculosis). They also would aid in the development and evaluation of population and disease management methods for feral swine, such as vaccines and vaccine delivery methods.

<u>Education and Outreach</u>

National level communication support will be available including but not limited to the development of a strategic communication plan, key messages, and related outreach materials and events. APHIS will work with agency partners, Tribes and private entities to identify appropriate audiences, messages, materials, and actions/events. National level assistance will be available to APHIS program spokespeople in the States and Territories when responding to media inquiries, and identifying and coordinating proactive media opportunities.

<u>Disposal of Swine</u>

The number of feral swine removed by APHIS-WS would substantially increase under this alternative. In addition to conformance with applicable APHIS program policy for carcass disposal, as described under Sections G (Standard Operating Procedures) and E.11. (different disposal methods), the APHIS-WS Feral Swine Program Manager would work with appropriate APHIS-VS personnel and agency and Tribal partners to review current carcass disposal guidelines, and develop or refine additional guidelines and methods.

<u>Regulatory Actions</u>

States, Territories, Tribes, and local governments are the primary entities with regulatory authority pertaining to feral swine hunting, animal production practices, and the sale and movement of animals in their jurisdiction. The lead and cooperating federal agencies have limited regulatory authority for feral swine management. APHIS does not propose to modify its existing regulations at 9

CFR 78.30(c) which restrict the interstate transportation of animals at this time. APHIS would continue to assess the effectiveness of these regulations, and would also work with Federal agency partners to investigate other regulatory options under their authorities. These efforts could aid in reducing feral swine damage and help prevent illegal movement of swine. (See also Section F.2.b. below). APHIS would also work with Federal, State, Territorial, Tribal and local partners on education and outreach efforts pertaining to feral swine regulations, and the need for feral swine management. (See also Section F.2.b below.)

Coordination with Neighboring Countries

Feral swine are known to move across borders between the United States and Mexico and Canada on their own and through human intervention. This alternative would address issues associated with feral swine along these borders. APHIS- VS, -WS and -IS would work collaboratively with Mexico and Canada to develop plans to reduce movement of feral swine and associated damage and disease risks.

Evaluation and Monitoring

APHIS would monitor program adherence to conditions specified in the EIS, Record of Decision (ROD) including any required mitigation for compliance with relevant laws, regulations and program policies. APHIS would also develop performance measurements that are consistent with long-term strategic goals and objectives of the FSDM plan. This alternative would include research to develop performance measurements for monitoring accomplishments of the FSDM program including improved techniques to estimate feral swine populations and monitor population trends. Program monitoring and performance reports would be used to communicate with agency decision-makers and budget officials within USDA and APHIS and to guide and refine management practices in accordance with adaptive management practices.

### 5. Alternative 5—Federal FSDM Grant Program

Under this Alternative, APHIS would distribute National fsdm Program funding to States, Territories, Tribes, organizations representing Native peoples, and research institutions. APHIS' role in operational FSDM would be substantially diminished and APHIS-WS would not conduct any operational FSDM under this alternative. Entities currently receiving APHIS-WS assistance with FSDM would be referred to the grant recipient conducting the FSDM work in their area. All feral swine control actions would be implemented by grant recipients or their agents. APHIS-WS would not be able to be the grant recipient's "agent" under this alternative, which would restrict access to the expertise and resources available through APHIS-WS.

The National fsdm Program Manager would administer the Federal FSDM Grant Program to achieve the key project components described for the Integrated FSDM Program (Alternative 2; Section 2.b above). Grant distribution would place emphasis on empowering those entities with regulatory authority over the management of feral swine, and those which are most able to provide baseline operational assistance and meet national project priorities. Grant applicants would be encouraged to work collaboratively with entities in their area such as federal land managers and private organizations when developing their grant proposals. Feral swine education and outreach, and disease and population monitoring would be implemented at the discretion of grant recipient agencies and/or as directed through the grant.

Research grants would be included with this alternative, and would be distributed to non-APHIS applicant research institutions for feral swine-related research projects. Priorities for research grants would include emerging technologies, developing and evaluating performance measures for FSDM, economics of feral swine damage and damage management, and feral swine population modeling. However, NWRC would not be involved in feral swine research or product development. Research entities will not have the opportunity to benefit from NWRC wildlife damage management research experience and capacity to handle registration of feral swine toxicants and reproductive control materials.

The grants process would require more resources to administer than the Integrated FSDM Program (Alternative 2). Federal funding for FSDM through grants constitutes a significant federal nexus, which would require grant recipients to work with APHIS on compliance with federal regulations including but not limited to NEPA, ESA, and NHPA. Grant recipients would also be expected to comply with SOPs and mitigation measures established for the protection of the environment in this DEIS (Chapter 2 Section G). APHIS may not be able to provide more than minimal monitoring for compliance with these measures without reallocating substantial amounts of the funds that should go for project implementation to project monitoring. Consequently, less funds would be available for operational management and research than under the Integrated FSDM Program (Alternative 2).

**Table 2–1. Summary and Comparison of Alternatives with Additional Management Considerations**

| | **Alternative 1—Current APHIS FSDM Program (No Action Alternative)** | **Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative)** | **Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels)** | **Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity)** | **Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects** |
|---|---|---|---|---|---|
| **APHIS Program Components** | | | | | |
| National Coordination | No | Yes | Some. Similar to Alternative 1 with addition of national coordination of resources to increase baseline capacity to respond. | Yes | Yes, limited to allocation of resources through grant process. |
| Operational Damage Management by APHIS | Yes, where cooperator funding is provided. | Yes, with national funding to improve baseline capacity to respond and address national priority and strategic local projects. | Yes, with highest level of national funding allocated for baseline capacity to respond. No national funding specifically allocated to national priority or strategic local projects. | Yes, with expanded support for national priority and strategic local project areas. National funding to increase baseline capacity to respond may not be available to assist in all areas with feral swine. | None conducted by APHIS. Supported as funded through the grant process, and could be implemented by States, Territories, Tribes and organizations representing Native Peoples. |
| Eradication and Containment at National, State, Tribal, or Territorial Levels by APHIS. | Limited to actions initiated and funded by States, Territories, and Tribes. | Yes, Priorities set based on a combination of national feral swine population management objectives and State, Territorial and Tribal management objectives (e.g., prevention, eradication, reduction, game species) | Similar to Alternative 1 but with increased resources for baseline capacity. No strategically coordinated effort to stabilize and reduce national feral swine population | Similar to Alternative 2 except all funding would be committed to national and strategic local projects. Increases capacity to eradicate and contain feral swine in priority States, Territories, and Tribal lands. | Supported as funded through the grant process. Could be implemented by States, Territories, Tribes and organizations representing Native Peoples |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| APHIS Disease Monitoring | Yes, national efforts are primarily opportunistic to other damage management actions. Targeted local efforts may occur if cooperator funding is provided. | Yes, at elevated levels with nationally coordinated and targeted sampling | Yes, similar to Alternative 1, but with increased resources associated with improved baseline capacity to respond. | Yes, similar to Alternative 2 but through national and strategic local projects only. | APHIS would not have field staff in place to assist in the same manner as Alternatives 1–4. Grant recipients (States, Territories, Tribes, and organizations representing Native peoples) could submit samples. |
| Rapid Response to New Populations of Feral Swine in otherwise Swine-free States | Very limited capacity. Relies on cooperator initiation and funding. | Yes | Same as Alternative 1 because baseline resources would be provided only to States with existing feral swine populations. | Yes | No APHIS response other than support through grant program. Response would be implemented by States, Territories and Tribes. |
| Research | Some based on limited funding. | Increases research activities over Alternative 1. | Same as Alternative 1. | Same as Alternative 2. | No research by APHIS. Increased research by other research institutions supported through grant program. |
| Education/Outreach | Cooperative partnerships, technical assistance at APHIS-WS State program levels. Incorporated into other/existing activities. Limited | Includes development and implementation of a strategic communication plan for outreach materials and events. Plan prepared in collaboration with partner agencies and Tribes to identify and address needs | Same as Alternative 1 with additional outreach at the APHIS-WS state level through baseline funding. National level outreach and education same as for Alternative 1. | Same as Alternative 2 for states identified as priorities for FSDM. In States and Territories not identified as national FSDM priorities, local education and outreach would be similar to | As supported through grant program and at discretion of States, Territories and Tribes. |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| | national support. | and effective methods. Outreach would include support of Federal, State and Tribal regulations which discourage activities that contribute to the feral swine problem. | | Alternative 1 with some indirect benefits from national FSDM efforts. | |
| Review of Federal, State, Territorial and Tribal Feral Swine Regulations | No coordinated review of State regulations. APHIS-VS has regulatory oversight of Federal interstate movement of feral swine. | No new Federal regulations are proposed at this time, however, APHIS would review and monitor existing regulations at the State, Territorial, and Tribal levels. APHIS would support State, Territorial, and Tribal agency efforts to develop effective regulations. | Same as Alternative 1 | Same as Alternative 2 | Same as Alternative 1 |
| Coordination with Canada and Mexico | Limited to the local State, Territory and Tribal level. | National coordination with Canada and Mexico to establish plans to address feral swine along common borders. | Same as Alternative 1 | Same as Alternative 2 | None by APHIS except as required for disease management by APHIS-VS. |
| APHIS Cooperative Partnerships | At State, Tribal, and local levels. | National, State, Tribal and local | State, Tribal, and local levels. | National, State, Tribal, and local levels. | Limited to grants process at national, State, Territorial, Tribal levels. |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| Population Monitoring | None, or opportunistic based on cooperator funding. | Yes, includes research and modeling support at the national level. | Yes, in all States currently with feral swine. | Yes, includes research and modeling support at the national level. | Through grant process and at discretion of States, Territories, Tribes and Organizations representing Native peoples. |
| **Coordination and Management** | | | | | |
| APHIS Program Leadership and Coordination | APHIS-WS State management under regional and national APHIS-WS leadership, but no nationally coordinated FSDM strategy. National leadership for work by NWRC. | National FSDM Program established under national oversight to coordinate activities across APHIS organizations. National FSDM Program Manager works with APHIS-WS State, regional and national leadership as under Alternative 1. | Same as Alternative 2 except all coordination would be limited to baseline operations | Same as Alternative 2 except all coordination would be limited to national and strategic local projects, with no baseline. | Same as Alternative 2, but limited to distribution of grants. |
| Operations Project Management – Direct Control and Technical Assistance | APHIS-WS State Directors as established in cooperative agreements with cooperators. | Same as Alternative 1 but coordinated with National FSDM Program | Same as Alternative 1 | Same as Alternative 2 | State, Territorial, and Tribal agencies with feral swine management authority or as authorized by States, Territories, and Tribes |
| Disease Monitoring (APHIS disease monitoring tied to staff in operations). | Nationally coordinated through APHIS National Wildlife Disease Program. Local | Nationally coordinated through FSDM program. Uses risk-based modeling for targeted disease sampling. Includes local | Same as Alternative 1 | Same as Alternative 2 | No disease monitoring by APHIS. Could be implemented by States, Territories. Tribes and organizations |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| | collaboration. Primarily opportunistic sampling. | collaborative efforts. | | | representing Native Peoples that receive grants. |
| Research | NWRC project management. | Same as Alternative 1 with coordination through National FSDM program. | Same as Alternative 1. | Same as Alternative 2. | Coordination and management limited to allocation of funds through grant program. |
| Communications and Outreach | APHIS-WS State Directors, NWRC. | Same as Alternative 1 with National fsdm Program coordination and management. | Same as Alternative 1. | Same as Alternative 2. | Limited to only that needed to solicit participation in the grant program. |
| **Funding** | | | | | |
| Funding Sources | Primarily cooperator funding from Federal, State Territorial, Tribal, and local entities and/or landowners. | Same as Alternative 1/ but adds Federal cost-share baseline capacity to respond at APHIS-WS State levels. Adds Federal funding for national and strategic local projects. | Same as Alternative 1 but adds Federal cost-share with increase in baseline capacity at APHIS-WS State levels. | Same as Alternative 1 but adds Federal funds for national and strategic local projects. No baseline funding to APHIS-WS State programs. | Federal Grants. Cooperator funding would still be available. |
| Funding Prioritization | Funding priorities established by requesting cooperators. | National funding for baseline capacity to respond in all States with feral swine based on feral swine activity, followed by consideration of resources protected, State laws and regulations that may affect success, and | Priorities for national funding to improve baseline capacity to respond same as in Alternative 2. No national or strategic local projects. | Same as Alternative 2 but no funding to improve baseline capacity to respond. | Grants issued to achieve same goals as Alternative 2 with similar system of funding priorities. |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| | | geographical and spatial distribution of swine. Nationally generated projects would be identified based on capacity to achieve goal of reducing range and size of national feral swine population. Strategic local projects selected to augment efforts to protect sensitive resources and national population management goals. | | | |
| **Personnel** | | | | | |
| Operational (includes disease monitoring) and Research Personnel | APHIS current staff. | APHIS current staff, adding staff transfers and temporary hires. | Same as Alternative 2. | Same as Alternative 2. | Grant recipients including State, Territory, and Tribal agencies, Organizations representing native people, and their designated agents. |
| Administration | Existing APHIS regional and State staff. | National FSDM Program, with existing APHIS regional staff and APHIS State Directors. | Same as Alternative 2. | Same as Alternative 2. | National FSDM Program administers grant program. |

| | **Alternative 1—Current APHIS FSDM Program (No Action Alternative)** | **Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative)** | **Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels)** | **Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity)** | **Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects** |
|---|---|---|---|---|---|
| **Feral Swine Damage Management Tools and Environmental Protection Measures** | | | | | |
| Operational Tools for Feral Swine Damage Management | All legally available methods (Section 2.C) using APHIS-WS Decision Model (Slate et al. 1992, Figure 2-1) | Same as Alternative 1 but increased funding for research. Increased research capacity will facilitate improvement of existing methods and development of new methods. New methods development may include registration of chemical methods already under development (e.g., sodium nitrite and GonaCon™). | Same as Alternative 1 | Same as Alternative 2 | All methods legally available to grant recipients. |
| Mitigation and SOPs | Mitigation measures are built into existing programs as SOPs and in project-specific agreements for control. | Mitigation measures have been built into the current program as SOPs (Section 2.D). Additional locally developed measures adopted as needed. | Same as Alternative 2 | Same as Alternative 2 | APHIS would require implementation of mitigation and SOPs by grant recipients as a condition of funding. APHIS would need to allocate staff to monitor mitigation or SOP implementation. |

| | Alternative 1—Current APHIS FSDM Program (No Action Alternative) | Alternative 2—National fsdm Program (Includes Baseline Capacity, National, and Strategic Local Projects) (Preferred Alternative) | Alternative 3—Baseline APHIS FSDM Program (Support Based on Swine Population Levels) | Alternative 4—National and Strategic Local Projects Program (No Federal Support for Baseline Capacity) | Alternative 5—Federal FSDM Grant Program (Includes Baseline Capacity, National and Strategic Local Projects |
|---|---|---|---|---|---|
| **NEPA Compliance** | | | | | |
| Post EIS/ROD NEPA Considerations - Operations | Current projects are addressed by APHIS-WS at State, Territorial or local level in Environmental Assessments and Categorical Exclusions, depending on scale of project and anticipated impacts. | May require further site-specific NEPA compliance for consistency with Record of Decision (ROD) resulting from this EIS. | Same as Alternative 2 | Same as Alternative 2 | May require further grant- specific NEPA compliance for actions not fully assessed in this EIS. |
| **Program Monitoring** | | | | | |
| Evaluation and Monitoring. | Programs monitored to assess efficacy and impacts as well as, compliance with federal regulations, including NEPA, and program policy. Monitoring for operations is conducted at APHIS-WS State level for compliance with NEPA and all regulatory and policy requirements. | Alternative 1 with additional national program monitoring of performance to be planned, implemented, and incorporated into adaptive management decision-making. Includes research to improve monitoring of program efficacy. | Same as Alternative 2, but no increase in research to develop improved monitoring systems. | Same as Alternative 2 | Same as Alternative 2 |

## E. Discussion of Feral Swine Damage Management Methods Available for Use in All APHIS Alternatives

This Section includes a review of all FSDM strategies currently available for use or recommended by APHIS for FSDM under any of the available alternatives.

### 1. Technical Assistance

#### *a. Education, Communication, and Outreach*

Education is an important element of FSDM activities, and facilitates finding balance and coexistence between the needs of people and the needs of wildlife. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, APHIS would provide lectures, courses, and demonstrations to producers, homeowners, State and county agents, colleges and universities, and other interested groups. Technical papers have been, and would continue to be, presented at professional meetings and conferences so that other wildlife professionals and the public would be periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies. Technical assistance may also include loaning damage management equipment to cooperators seeking to reduce feral swine damage.

Legislative and Public Affairs (LPA) is the lead group within APHIS for development of communication and outreach on FSDM. APHIS-LPA provides effective communications and outreach products for a large number of partner and stakeholder groups, along with members of the general public. APHIS-LPA and -WS work with agency partners, Tribes, universities, extension programs, and other cooperators to develop educational materials and opportunities to inform cooperators and the general public about feral swine issues and methods to resolve problems. Potential workshop activities may include training personnel from agencies and Tribes on methods to monitor and capture feral swine, to working with communities to address feral swine damage in urban areas, to methods for protecting endangered species.

#### *b. Regulatory Support/Advice*

State, Territorial, Tribal, and local governments have primary authority for the management of feral swine. However, the NPS has primary authority to manage feral swine within the boundaries of units in the National Park System. Feral swine regulations and policies developed by these entities are critical to the success of FSDM and eradication programs. Variation among jurisdictions complicates management, and is particularly problematic for agencies, Tribes, and other landowners/managers who maintain properties that cover multiple jurisdictions.

APHIS can work with agency partners to foster communication among regulatory agencies, and provide information on existing regulations and regulations which aid or hinder FSDM. APHIS' technical assistance programs can also work with agency partners and the research program, discussed in Section 9 below, to prepare and identify materials on the impacts of feral swine, which may aid elected and agency officials in developing regulations on feral swine.

## 2. Surveillance

Surveillance involves direct observation, camera systems, hunter surveys and other systems to monitor for the presence or absence of feral swine. Aerial surveillance using fixed-wing aircraft, helicopters, and drones would be used to evaluate and monitor damage, locate feral swine populations for control, monitor feral swine ranges and movement patterns, and obtain information pertinent for local population estimates. Manned aircraft would have a trained observer to conduct visual searches and to document findings. As with aerial shooting, the APHIS-WS' program aircraft-use policy helps ensure that aerial surveys are conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must also be certified under established APHIS-WS' program procedures and policies (APHIS-WS Directive 2.62).

### *a. Judas Pigs/Telemetry*

This technique involves attaching a radio-collar to a feral swine (preferably an adult female) and releasing it with the expectation that it would join a sounder (Mayer 2009*b*).[6] Prior to its release, the pig may be sterilized to prevent reproduction. Once the sounder's location is established, feral pigs associated with the "Judas" pig are removed with live capture devices, hunting with dogs, or shooting. The collared pig is allowed to escape, to join another sounder, and the process is repeated. The success of this technique depends on the formation and stability of groups which can vary substantially among seasons (Pech et al. 1992) and may also vary with the distribution of food and water resources. This technique is target-specific and has minimal impact on other species. Adult sows are preferred for this type of action because they are the most likely to seek to join a sounder after release. Adult males join sounders infrequently and immature animals may be excluded from groups or seek to form temporary groups on their own (Mayer 2009*b*).

Radio-collared animals may be located using a hand-held antenna and radio receiver. However, feral swine can move significant distances. When they cannot be located from the ground, they may be located using radio telemetry from fixed-

[6] A sounder is a group of swine, usually related adult females with their sub-adult and juvenile offspring (Kaminski et al. 2005, Poteaux et al. 2009).

wing aircraft or helicopters. Global Positioning System (GPS)-based telemetry systems may also be used.

### *b. Night Vision and Forward Looking Infrared (FLIR) Devices*

Night vision and Forward Looking Infrared Devices (FLIR) equipment aid in locating feral swine at night when they may be more active. Night vision and FLIR equipment could be used during feral swine surveys, and in combination with shooting to remove feral swine at night. APHIS-WS' personnel would most often use this technology when responding to assistance requests for damage caused by feral swine. FLIR devices would be used to target feral swine in the act of causing damage, or likely responsible for causing damage. The use of these methods allows APHIS-WS to conduct FSDM activities at night when human activities are minimal, thereby, reducing risks to human safety.

### *c. Camera Systems*

Remote camera systems are a valuable surveillance tool. Feral swine have poor eyesight, and rely primarily on their sense of smell which makes them sensitive to human presence. APHIS-WS' personnel may use remote trail cameras to minimize human presence at trapping sites, and to monitor large tracts of land. Some cameras contain a GPS modem that transmits images instantly to a private access web system. This allows personnel to minimize travel expenses and monitor feral swine activity without disturbing bait and trap sites. Trail cameras allow for the monitoring of feral swine movement patterns and responses to prebaiting. Camera systems may be used with remote-activated cage traps to maximize the chance that an entire sounder is captured and minimize risks to non-target species.

### *d. Aircraft Including Unmanned Aircraft*

Surveillance from manned aircraft is a commonly used technique in wildlife management and, depending on environmental conditions, can be an effective and efficient means of locating feral swine. Surveillance from aircraft can be a tool for measuring feral swine damage over large areas. Monitoring sites from the air can be less expensive than ground surveillance for remote areas and can reduce the need to physically visit the site from the ground and associated environmental impacts (e.g., soil and vegetation disturbance; Watts et al. 2010, Koh and Wich 2012). The difficulty in locating animals in heavy vegetation can be a limiting factor, and the method is best suited to areas with sparse vegetation and use in winter when vegetation is limited and snow can facilitate location of swine. Thermal imaging systems (Section 2.b above) may also be used in combination with aircraft to facilitate locating swine. The APHIS-WS program currently uses manned aircraft for feral swine surveillance. The APHIS-WS' program aircraft-use policy (APHIS-WS Directive 2.620) helps to ensure that aerial hunting is conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must be certified under established APHIS-WS' program procedures.

Unmanned aircraft are receiving increasing attention as a wildlife management tool (Watts et al. 2010, Koh and Wich 2012, Martin et al. 2012) and have been adapted by private entities for use in locating feral swine (Hirsch 2013, The Economist 2013). As with manned aircraft, unmanned aircraft could also be used to conduct surveillance for feral swine damage. Unmanned aircraft generally produce less noise, use less fuel and are generally less expensive to operate than manned aircraft (Watts et al. 2010). Use of unmanned aircraft eliminates the safety risk to pilots and flight crews (e.g., observers), inherent in low-altitude flights used for wildlife management. In the private system currently in place, remote-controlled aircraft are used to locate the swine and locations are relayed to hunters who go to the site and remove the swine (The Economist 2013). APHIS-WS is not currently using unmanned aircraft operationally for FSDM. All use of unmanned aircraft would be conducted in accordance with applicable Federal, State, Territorial, Tribal, and local regulations.

### 3. Ground Shooting

Shooting is a commonly used method to remove free-ranging feral swine, or to euthanize feral swine caught in live-capture devices. Shooting to remove free-ranging swine may occur during the day or at night using spotlights, night-vision equipment or thermal imaging. Firearms may be equipped with noise suppressors to avoid disturbance, and to facilitate success by minimizing the tendency of feral swine to flee from the sound of gunfire. Elevated shooting sites, such as tree stands, truck beds or other vantage points, may be used, where appropriate, to improve safety and efficacy. Elevated positions cause a downward angle of trajectory; therefore, any bullets that inadvertently miss or pass through targeted feral swine will enter the ground or earthen embankments. This minimizes the risk of stray bullets that could present a safety hazard to people, pets, or property. Nontoxic bait (food) may be used to attract feral swine to safe sites for shooting, and to enhance success and efficiency. The selection and use of firearm and ammunition types would be in compliance with local laws and regulations, as well as the policies of the cooperating and participating agencies.

Firearm use is a sensitive issue and a public concern due to the potential for misuse of firearms. To ensure safe firearms use and awareness, APHIS-WS' employees who use firearms to conduct official duties are required to attend an approved firearms safety-and-use training program within three months of their appointment, and a refresher course every two years afterwards (APHIS-WS Directive 2.615). Wildlife Services' employees who carry firearms as a condition of employment are required to sign a form certifying that they meet the criteria, as stated in the Lautenberg Amendment (18 U.S.C. 922), which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

### 4. Aerial Shooting

Aerial shooting (shooting from an aircraft) is a commonly used FSDM method. Aerial shooting has been identified as a viable tool for feral swine management in the United States (West et al. 2009, Campbell et al. 2010*a*). Reported removal rates for aerial shooting range from 9–39 swine per hour (Hone 1983, Saunders and Bryant 1988, Campbell et al. 2010*a*). Some APHIS-WS programs in areas with ideal conditions for aerial hunting and high densities of feral swine have had higher removal rates, up to 70 feral swine per hour (M. Bodenchuk, APHIS-WS Texas, pers. comm., 2014). Differences in swine density, climate, terrain, and plant cover account for most of the variation in capture rates. Although aerial shooting is an expensive method, APHIS-WS' experience with feral swine removals indicates that the staff time, travel time, and labor required to achieve similar results using ground-based methods will likely make aerial shooting a cost-effective option.

Aerial hunting is species-specific and can be used for immediate control to reduce damage if weather, terrain, and cover conditions are favorable. Fixed-wing aircraft are most frequently used in flat and gently rolling terrain, whereas helicopters, with better maneuverability, have greater utility and are safer over rugged terrain and timbered areas. In broken timber or deciduous cover, aerial hunting is more effective in winter when leaves have fallen and snow cover improves visibility.

The APHIS-WS' program aircraft-use policy (APHIS-WS Directive 2.620) helps to ensure that aerial shooting is conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must be certified under established APHIS-WS' program procedures and only properly trained APHIS-WS' employees are approved to shoot from aircraft. Although unmanned aircraft could be used in conducting surveillance for feral swine (measuring damage and locating swine), APHIS-WS is not proposing to shoot swine from unmanned aircraft.

### 5. Tracking with Dogs

Tracking/Trailing dogs and "Bay" dogs are commonly used to locate and "hold" feral swine (Mayer et al. 2009). The dogs become familiar with the scent of the animal they are to track, and will howl when they smell them. Tracking dogs are trained to follow the scent of target species, and to ignore the scents of non-target species. If the track of the target species has not degraded beyond what the dogs can detect, the dogs can follow the trail and temporarily surround or hold the feral swine at bay. The dogs stay with the animal until the APHIS-WS employee arrives and dispatches (via gunshot), tranquilizes, or releases the animal, depending on the situation. Handlers arrive at the site of encounters between feral swine and dogs as quickly as possible to minimize stress to the swine and risk of injury to dogs. Dogs are not allowed to kill swine. Handlers are encouraged to use protective equipment for dogs (see Mayer et al. 2009 for examples). Hunting with dogs is particularly useful in areas with thick vegetation which are difficult to access, and where visibility is limited, especially in southern areas where year-round vegetation limits the utility of aerial shooting. Use of dogs can be limited seasonally in some areas due to heat impacts on dogs or weather conditions unfavorable to dogs detecting the scent of swine.

Although trained dogs usually stay on the trail of the target species, it is possible that the dogs will switch to the fresher trail of a non-target species while pursuing the target species. This sometimes occurs if the hounds are less experienced, but running less-experienced hounds with more-experienced hounds reduces the likelihood of this occurrence. In addition, as soon as the APHIS-WS employee realizes that the dogs have switched from a target species to a non-target species, the dogs are called off from tracking, and the non-target animal is allowed to escape. Radio tracking collars will be used on dogs to facilitate recovery and prevent dogs from getting lost.

## 6. Live Capture Systems

### *a. Cage and Corral Traps*

Box or cage traps are usually rectangular and are made from various materials, including metal, wire mesh, plastic, and wood. These traps are well suited for removing small numbers of animals from residential areas, and work best when baited with foods attractive to feral swine. Box traps are generally portable and easy to set-up.

Corral traps are large circular or oval traps consisting of panels anchored to the ground using steel posts, with a door allowing entrance and an open top. As with cage traps, bait is used to draw the swine into the trap. Side panels are typically woven metal fencing, and are referred to as hog panels or cow panels. The entrances into the traps generally consist of a door that allows entry into the trap but prevents exit. The doors are often designed to allow swine to continually enter the trap which allows for the possibility of capturing multiple swine and can be used to remove entire sounders at one time.

The disadvantages of using cage and corral traps are: 1) some individual feral swine may avoid cage traps (Saunders et al. 1993); 2) some non-target animals may associate the cage traps with available food and purposely get captured to eat the bait, making the trap unavailable to catch target animals; 3) cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions; 4) some animals will fight to escape and may become injured; 5) materials to construct the traps are expensive; 6) once constructed, corral traps are not moveable until disassembled and transported; and 7) in remote areas, transporting the required equipment can be difficult.

Trap monitoring devices may be used in some situations. Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed, and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap, or attached to a string or wire, and then placed in a tree or shrub away from the trap. When the monitor is hung above the ground, it can be detected by the receiver from several miles away, depending on the terrain in the area.

There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area. Trap monitoring devices allow personnel to prioritize the traps they check and decrease the amount of time required to check traps, thereby decreasing the amount of time captured target or non-target animals are restrained in the trap. By reducing the amount of time target and non-target animals are restrained, potential stress and injury are minimized.

Cage traps may also be monitored and activated from remote sites using video systems. Camera systems send images to off-site devices. Users of the system can monitor activity in the project area to obtain information on the number of animals in a sounder, and the extent to which animals are entering the trap area. Some live trap systems have remote-activated triggers that can be activated by a remote user when the desired number of animals is observed in a trap. Remote observation and activation of triggers also substantially reduces or eliminates risks of trapping non-target species. However, use of remote monitored and activated systems is limited by the expense of the systems.

Recent variations on corral traps include a method which elevates the trap that allows pigs to enter and exit the project area without encountering trap doors or walls. This reduces problems with trap-wary behavior (Gaskamp and Biermacher 2013). The trap is "dropped" when the trigger mechanism is activated by an individual observing the site electronically from a remote location. This helps eliminate the risk of capturing non-target species in the trap.

***b. Drop Nets***

Drop nets are large nets set over a baited area to capture vulnerable target species. Drop nets have been used for other ungulate species, such as deer, for many years. Until recently, drop nets had not been evaluated for feral swine. Guskamp and Gee (2011) published a study comparing the effectiveness and efficiency of a drop net and a traditional corral trap for trapping feral swine. A mark and recapture analysis showed more swine were removed with drop nets (93%) than with corral traps (55%). Efficiency estimates for the average time per capture were 1.9 hours for drop nets and 2.3 hours for corral traps. Feral swine did not appear to exhibit trap shyness around drop nets, which often allowed the researchers to capture entire family units (sounders) in a single drop. The use of drop nets also eliminated the capture of non-target species because the device is activated remotely by a person who can see the target area. Results of this study indicate that drop nets are an effective tool for capturing feral swine. Disadvantages of drop nets are that an observer must be nearby to monitor the net and then euthanize the hogs before they escape from the nets.

### *c. Snares and Cable Restraints*

Cable restraints, or snares, are typically made of wire or cable consisting of a loop, which are positioned to close around the neck, torso, or foot of a target animal as the animal moves through the loop. When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held. Neck snares are used effectively to capture a broad range of species (Muńoz-Igualada et al. 2010, Wegan et al. 2014) and may be used as either lethal or live-capture devices (i.e., cable-restraint) depending on how or where they are set (AFWA 2009). Snares set too close around the neck of an animal are usually intended to be a lethal method. Snares are an integral tool when managing feral swine damage. They can be placed where an animal moves through a confined area (e.g., crawl holes under fences, trails through vegetation, etc.) where other trapping methods may not be applicable. The height that the snare is set above the ground and the diameter of the snare loop can reduce the number of non-target animals captured. Proper loop size and placement allows animals smaller than the target species to pass through or under the device. Minimum diameter stops allow the snare cable to close only to a certain diameter that can allow deer and other non-target animals to escape. Additionally, a relaxing lock allows the cable to release constriction pressure when the cable is not taut (e.g., when the animal stops pulling) which reduces the possibility of strangulation.

Foot snares are set on or just under the surface of the ground, and can be triggered passively (e.g., by the animal pulling) or activated by an animal stepping on a pan or trigger which tightens the noose around the top of the hoof. Foot snares are live-capture devices and can be set with a loop size smaller than the diameter of larger animals, such as black bears, to prevent accidental capture. Foot snares are effective tools for capture of feral swine that may be trap shy and in areas where transporting larger traps is not feasible.

Risks of non-target capture do occur when using cable restraints or snares. Snares must be set in locations where the likelihood of capturing non-target animals is minimized. Risks associated with snares are greatest for non-target animals that frequent the areas where snares are placed and travel along the paths of the target species. APHIS-WS' personnel perform a thorough search for evidence of non-target animals (tracks, scat, etc.) prior to setting snares for feral swine. When attractants are used (i.e. bait or lures), it reduced the chance of non-target activity at capture sites. Risks to non-target animals may also be reduced by adjusting the size of the loop and the height of the loop above the ground. Hazards to non-target animals associated with the use of snares could range from minor injuries to potential death. Snares would only be used by employees experienced in targeting and capturing specific animals, which would further minimize risks to non-target animals.

#### *d. Foothold Traps*

Foothold traps are not commonly used for FSDM, and are generally not effective as capture devices for adult swine. However, they can be a useful method for capturing small swine for research, radio collaring for a Judas pig application, or removal for damage management. Larger swine can easily pull free from foothold traps, but smaller swine may be held. Most take of swine in foothold traps is incidental to other damage management actions on the same property as the swine removal (i.e., a feral swine may be captured in a foothold trap on a property where APHIS-WS is working to remove swine and coyotes to address damage problems). If feral swine are captured in foothold traps set for other species they would most often be lethally removed.

Foothold traps for swine are usually set in the travel lanes of feral swine. Traps which rely solely on good placement to encounter an animal and do not use an attractant are known as "blind sets." Various tension devices can be used to prevent animals smaller than target animals from springing the trap. Site investigations and careful trap placement can help reduce risks to non-target species.

### 7. Non-Lethal Methods

APHIS-WS usually gives preference to non-lethal methods where practical and effective (APHIS-WS Directive 2.101). However, most non-lethal methods have limited efficacy in the management of feral swine (West et al. 2009). Although non-lethal methods can be used to protect specific areas (e.g., individual feeders, farms and some parks), the feral swine are still free-ranging to damage other natural resources outside the protected area. As noted in Chapters 1 and 3, the adverse impacts of feral swine on natural resources are serious enough that in many areas allowing swine to remain at large is undesirable. Currently available nonlethal methods fail to address problems with increasing feral swine populations and associated costs of damage and damage management. Consequently, non-lethal methods which relocate animals are of limited utility in FSDM.

#### *a. Exclusion*

Physical exclusion methods (e.g., fences and similar barriers) restrict the access of feral swine to resources. These methods provide a means of appropriate and effective prevention of site-specific damage management problems, and can reduce the risks of disease transmission between feral swine and domestic animals.

Predator-exclusion fences constructed of woven wire or multiple strands of electrified wire can be effective for feral swine in some areas. Electric fences were not completely effective in excluding swine but in rangeland tests 2-strand electric fences reduced incursions to bait stations 49% and resulted in a 64% drop in damage to sorghum crops when compared to unfenced areas (Reidy et al. 2008). However, fencing does have limitations. Even an electrified fence may not be swine-proof and, in some cases, the expense may exceed the benefit. If large areas are fenced, feral swine have to be removed from the enclosed area to make it useful. Some fences inadvertently trap, catch, or affect the movement of non-target wildlife. Physical exclusion methods impede the use of areas by many wildlife species, so use of these methods must be considered with care, especially in areas where migratory mammals, such as mule deer (*Odocoileus hemionus*), pass. However, in some situations it may be possible to design fences which exclude feral swine but still allow movement of other species. For example, fences have been designed that exclude feral swine from deer feeders, but still allow passage of deer (Rattan et al. 2010). Lastly, fencing is not practical or legal in some areas (e.g., restricting access to public land).

#### *b. Frightening Devices*

Frightening devices may use sound, lights, noise, pursuit, or other methods to disperse animals from the area to be protected. For example, Dakpa et al. (2009) developed a device which used noise and light to reduce wild pig damage to crops in Bhutan. These methods are best suited to short-term protection of relatively small areas. Methods which use light and sound, such as pyrotechnics and propane cannons, are often of limited efficacy because the animals eventually become accustomed to the stimulus and cease to respond to the device. In a study aimed at identifying deterrents for wild boar, Vassant and Boisaubert (1984) tested acoustic scarers, such as cannon firing at random, electronic sound generators, and wild boar alarm calls. The results showed that wild boar became habituated to all repellents within a few days. Although frightening devices can be effective for limited areas, there is the risk of displacing the problem from one area to another. Additionally, dispersing the swine may protect a project site, but will not resolve the larger issue of feral swine damage to native ecosystems or reduce problems associated with an increasing feral swine population.

### 8. Chemical Methods

#### *a. Immobilization and Euthanasia Drugs*

Chemical immobilization and euthanasia drugs are important tools for managing wildlife. Under certain circumstances, APHIS-WS' personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised, and chemical immobilization provides a good solution to reduce these risks. APHIS-WS' employees who use immobilization drugs are certified to use them, and must follow the guidelines established in the APHIS-WS' Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Telazol® (tiletamine) and Ketamine/Xylazine are immobilizing agents used by APHIS-WS to capture and remove wild animals. These are typically used in urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system (e.g., darts from rifle, pistol, or blow guns, syringe pole, or hand-fed baits). Immobilization is usually followed by euthanasia. Euthanasia is usually performed with drugs such as Beuthanasia-D® or Fatal-Plus® which contain forms of sodium phenobarbital (APHIS-WS Directive 2.430). Euthanized animals are generally disposed of by incineration or burial (on-site or landfill) to avoid secondary hazards. Drugs are monitored closely and stored in locked boxes or cabinets in accordance with APHIS-WS' policies, and U.S. Department of Justice (DOJ), Drug Enforcement Administration (DEA), FDA, and applicable State regulations and guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from DOJ-DEA held by APHIS-WS.

***b. Reproductive Inhibitors***

Reproductive inhibitors are currently under investigation as a potential nonlethal option to help reduce feral swine populations and associated damage. However, at this time, no methods are currently approved by EPA or FDA for feral swine control. Registration of a contraceptive will require extensive laboratory and field testing. These methods are being included in the EIS to the extent that information is available to facilitate NEPA review for research on these methods, and their incorporation into future program activities in the event that the methods are registered for this application.

APHIS-WS' NWRC has been instrumental in the development of a contraceptive agent called GonaCon™ registered for use in female white-tailed deer and free-ranging horses and burros that also is effective in feral swine (Killian et al. 2006, Campbell et al. 2010*b*). GonaCon™ is a gonadotropin-releasing hormone (GnRH) immunocontraceptive vaccine which is delivered as a single shot. The vaccine stimulates the production of antibodies that bind to GnRH (a hormone in an animal's body that signals the production of sex hormones). By binding to GnRH, the antibodies reduce the release of sex hormones, causing reduced breeding activity. Research is needed to support a potential registration for use in feral swine, and NWRC is working on the development of an oral delivery vaccine. Sufficient information is available on the injectable formulation of GonaCon for a detailed analysis in this DEIS. Consequently, if registered, an injectable formulation of GonaCon could potentially be incorporated into an operational APHIS-WS program depending on the management alternative selected.

Insufficient data is available on a feed-based application for environmental analysis at this time and additional analysis pursuant to NEPA would be needed before a feed-based formulation could be used operationally.

Self-administered feed-based formulations would be needed for cost effective contraceptives. However, oral vaccines need to be species specific because they would be distributed in uncontrolled environments where there might be accessible to non-target species. Species specificity can be achieved through feeder design and bait formulation, the type of contraceptive agent, or a combination of the two. Research on feeders and bait formulations is underway (Twigg et al. 2005, Campbell and Long 2007, 2008, 2009*b*; Campbell et al. 2011), and research investigating more species-specific contraceptives is also ongoing.

The Auburn University's School of Forestry and Wildlife Sciences and its College of Veterinary Medicine are working on a species-specific oral contraceptive for use in feral swine (Samoylova et al. 2012). Zona pellucida (ZP) are the membranes surrounding mammalian eggs. Sperm-ZP interaction is proposed to be the major factor which defines species specificity of mammalian fertilization (Reid et al. 2011). The Auburn University project involves identification and development of phage-peptide constructs that bind to ZP through epitopes that mimic sperm proteins at fertilization (Samoylova et al. 2012). Immunization with these peptides stimulates production of anti-sperm antibodies which can impede reproduction. Their research has identified candidate peptides which appear to trigger sufficiently intense and species specific immune responses to warrant additional development in a contraceptive vaccine for pigs.

***c. Repellents***

A large number of olfactory, acoustic, and gustatory repellents have been developed to decrease the impact of wildlife on human activities (Conover 2002). Deterrent properties of repellents vary depending upon circumstances. Repellents may be more effective in situations where alternative foods are readily available, or the target animals are unfamiliar with the food source or site. Repellents are less reliable in situations where alternate food sources are limited and animals are familiar with or prefer the food source. In a study aimed at identifying deterrents for wild boar, Vassant and Boisaubert (1984) tested 25 potential chemical repellents and acoustic scarers, such as cannon firing at random, electronic sound generators, and wild boar alarm calls. The results showed that wild boar became habituated to all repellents within a few days. In China, Cai et al. (2008) found similar results with odor repellents used by local farmers to protect crops against wild boar, and concluded that the only effective measure was the presence of humans in the field. In France, Vilardell et al. (2008) tested two potential odor repellants to protect tortoise nests from predation by wild boar, and found both repellants ineffective. In contrast, in pen trials with a limited number of pigs, Santilli et al (2005) determined that 3 topical repellents (repellents applied directly to the material to be protected) available for use to deter other species (Hot Sauce®, Tree Guard® and Morkit®) also reduced consumption of corn by pigs. The authors noted that the repellents were more effective when untreated food was available and suggested that the products may be effective in reducing swine damage to newly planted corn if diversionary food was available.

#### *d. Toxicants*

Sodium nitrite is a common meat preservative and has been shown to be a quick-acting, low-residue toxicant for lethal feral swine control. A sodium nitrite bait formula patented as Hog-Gone® has been under development in Australia (Lapidge et al. 2012). There are currently no toxicants registered for use in feral swine control in the United States. NWRC researchers are collaborating with Australian scientists in the development and U.S. registration of a bait product similar to Hog-Gone.® NWRC is evaluating its effectiveness, potential effects on non-target species, and swine-specific delivery systems to reduce risks to non-target animals. Once an appropriate bait formulation and bait-delivery method are determined, APHIS may conduct field trials to further assess the efficacy of the product for use in the United States. If these field trials indicate that the product may be safely and effectively used in the United States, product registration with EPA and State agencies would be needed before sodium nitrite could be used.

### 9. Research and Development

NWRC, a branch of the APHIS-WS' program, provides scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. (Research activities are summarized in section D.1.d, and include control and trapping techniques, economic analyses, and biological modelling.) As new information becomes available, it will be incorporated into the FSDM program.

### 10. Non-Federal and Private Control Options

#### *a. Private Control Operators*

Private wildlife control operators are fee-for-service companies that can, with the appropriate Federal and State permits, trap, capture, transport, or euthanize several damaging wildlife species, including feral swine. They operate as private enterprises and set their own fees. In some instances, private control operators have assisted successfully in eradication efforts (Parkes et al. 2010). However, larger-scale population control or elimination of swine may be problematic for these operators because of the wide geographic scope of the project, financial disincentives for eradication, lack of regulations or enforcement on feral swine movement, and the over-all scale of the project.

### *b. Hunting*

For purposes of this analysis, hunting refers to the capture and removal of pigs by the public, primarily for recreation or food. Hunting also involves implicit assumption of the principle of fair-chase which does not apply to FSDM removals. When removals are needed for damage management, the goal is to remove the animals in as humane and efficient a manner as possible, while minimizing the risk of adverse impacts on human safety and the environment. In this situation, the concept of fair-chase does not apply.

Laws and regulations regarding the management of feral swine vary by State (Appendix D, Table 1). Some States and Territories currently allow for the recreational take of feral swine as game animals, pursuant to a State hunting license as game or non-game animals. These States are responsible for establishing hunting seasons, bag and possession limits, and allowable methods of take. Hunting does result in the removal of feral swine, and may help reduce total number of swine in an area. However, there are some concerns and limitations regarding the use of this method. In many areas, recreational hunting has done little to manage feral swine populations. For example, Florida allows feral swine hunting year round with no bag limit, yet it maintains one of the highest feral swine populations in the country (FFWCC 2014). Unfortunately, illegal movement and release of swine to create local hunting opportunities by some hunters has contributed substantially to the rapid spread of feral swine in recent years (Bevins et al. 2014). Agencies may be reluctant to encourage or endorse a practice which has contributed to the feral swine problem. Agencies in States, Territories, or Tribes which are working to eradicate swine may also be concerned that introducing hunting as a control tool may lead to a situation where hunting groups start advocating for the State, Territory, or Tribe to retain feral swine populations for hunters to enjoy.

On public lands, use of hunting as a management strategy may also be limited by a number of factors, including the enabling language and mission of the site, safety concerns for other members of the public using the site, agency policies regarding hunting, and the potential for adverse interactions between hunting and other uses of the site. Further, hunting becomes increasingly less efficient as populations of the targeted species decrease. Hunters may not have the time, resources, or interest in the effort needed to remove the last swine from an area.

Although APHIS-WS, along with most natural resource agencies, discourage this practice because it can greatly expand the feral swine population, hunting may have utility in reducing feral swine populations in areas where swine are already widespread.

### c. *Removal by Certified Volunteers*

A certified volunteer system would allow volunteers who have applied for and received special training and certification to participate in feral swine removal. Volunteer certification would be managed by the State, Territory, Tribe, or individual landowners/managers, and they could potentially establish their own training requirements for volunteers on their lands.

## 11. Disposition of Feral Swine Captured or Killed for Damage Management

This section discusses methods available to APHIS for the disposal of feral swine removed during damage management. Factors that must be considered when selecting a disposal method include cost of the method, project logistics, environmental conditions at the project site, existing site use, and applicable Federal, State, Territorial, local, and Tribal regulations. For example, disposal methods that require collection and transport of large numbers of live animals/carcasses to a central location for processing are likely to be expensive and time consuming. The costs and logistics of collecting and processing animals are such that the methods may only be logistically viable if a large number of animals can be made available to the carcass disposal service provider at one time. Local regulations restricting the movement of feral swine within the State, Territory, or Tribal lands also need to be considered when selecting a swine disposal strategy. Choice of disposal methods can also impact the methods available to kill or handle the animal. For example, euthanasia chemicals may not be used on animals to be donated for human consumption, or for use by animal sanctuaries and zoos. Additionally, animals that are euthanized prior to the established withdrawal periods for immobilizing drugs would be subject to similar restrictions. Some States may have restrictions on the use of lead bullets and donation of meat. Disposal of all carcasses would be made in a manner that demonstrates APHIS-WS' recognition of public sensitivity to the viewing of wildlife carcasses (APHIS-WS Directive 2.515).

### a. *On-site Carcass Disposal Options*

<u>Leave Onsite</u>

Death of animals is a normal part of any natural ecosystem. In circumstances other than FSDM the carcasses of pigs that die due to predators, disease or other natural factors remain on the landscape and are scavenged and decompose through natural processes. This strategy involves leaving the animals where they are killed. This method offers several advantages, in comparison to other carcass disposal methods, such as lower disposal costs, providing a food base for scavengers, and lowering the potential for disease transmission to off-site locations. Leaving animals on site is often preferred for swine shot from aircraft because the cost of retrieving the swine with aircraft or ground crews can be prohibitive (especially in remote areas) and it minimizes the environmental impacts associated with accessing sites with vehicles from the ground. Feral swine carcasses would only be allowed to remain on-site with landowner permission, and if permitted by all applicable Federal, State, Territorial, Tribal, and local laws and regulations. In states and territories where permitted, this is one of the most common methods of carcass disposal currently in use

Food Use

Feral swine can carry a number of diseases transmissible to humans. Consequently, any consideration of feral swine donation for human consumption must include provisions to address risk of disease transmission. The Federal Meat Inspection Act requires feral swine to be inspected live, slaughtered under inspection, and processed under inspection to be eligible for donation. Animals euthanized offsite and delivered to USDA-licensed facilities are not eligible for donation. However, provided the animals have not been treated with chemicals that would preclude use as food (e.g., immobilization and euthanasia chemicals or any lethal control chemical without an approved food use) and if State regulations and permits allow, euthanized swine may be provided on request to the landowners for personal consumption. Landowners can process the swine on their own on their own property or take them offsite for processing if there is an available facility which will accept the animals.

Composting

Composting is the natural biological process of decomposition of organic materials in a predominantly aerobic environment. During the process, bacteria, fungi, and other microorganisms break down organic materials into a stable mixture called compost while consuming oxygen and releasing heat, water, and carbon dioxide and other gases. Under optimal conditions, composting results in a dark brown to black soil called "humus" containing primarily non-pathogenic bacteria and plant nutrients. A carcass composting system requires a carbon source (e.g., sawdust, straw, silage, manure, or leaves), bulking agents (e.g., sludge cake, spent horse bedding, or rotting hay bales), and biofilters (a biofilter is a layer of carbon source and/or bulking agent that enhances microbial activity, deodorizes the gases released at ground level, and prevents access by insects and birds) (NABCC 2004). APHIS-WS would not create new composting facilities to dispose of feral swine but landowners may choose to compost feral swine taken on their property. Landowners would be responsible for conducting composting in accordance with applicable Federal, State, Territorial, Tribal, county, and local regulations.

Burial

Wildlife carcasses may be discarded or buried on the property where they were killed, or deposited on another cooperator's property if approved by the respective property owner and allowed under applicable Federal, State, Territorial, Tribal and local regulations. All disposals would be made in a manner which demonstrates APHIS-WS' recognition of public sensitivity to the viewing of wildlife carcasses (APHIS-WS Directive 2.515). Carcass burial is an economically feasible option that, when performed on-site, eliminates the need for transportation of potentially infectious material (NABCC 2004).

Open Air Burning

Incineration would likely be used only when burial is not feasible because burning tends to be difficult and expensive in terms of labor and materials. Because of safety and air quality concerns, APHIS does not anticipate using open air burning to dispose of carcasses. In the unlikely event that open air burning would be considered in a state or territory, use of this method would be analyzed separately at the local level for environmental impacts under NEPA.

***b. Off-site Carcass Disposal Options***

Food Use

As noted above for on-site disposal options, the Federal Meat Inspection Act requires feral swine to be inspected live, slaughtered under inspection, and processed under inspection to be eligible for donation in a facility approved by the USDA Food Safety Inspection Service (FSIS). Animals euthanized offsite and delivered to USDA-licensed facilities are not eligible for donation. Regulations and logistic challenges associated with transport of live feral swine increase disposal costs and limit the utility of this method. Additionally, in part because of the diseases which may be in feral swine, there are only a limited number of FSIS approved facilities which are willing to process feral swine. However, in some areas (e.g., Texas), mobile inspection and animal processing stations have been developed to meet the needs of the commercial game production industry. It may be possible to adapt these strategies for use with feral swine.

Burial in Landfills

In many States, disposal of animal carcasses in landfills is also an allowable option. However, individual landfill operators generally decide whether or not to accept carcass material. Commercial landfills, particularly those in compliance with the Resource Conservation and Recovery Act Subtitle D (landfills suitable for non-hazardous solid waste), have been evaluated for suitability, and the necessary environmental precautions designed and implemented. Landfills, therefore, pose little risk to the environment. However, several criteria need to be met before commercial landfills can be used, including meeting State/local environmental requirements and obtaining necessary permits. Cost of landfills may limit the use of this option, especially for large projects.

Incineration

Incineration would likely be used only when burial is not feasible because burning tends to be difficult and expensive in terms of labor and materials. Because of safety and air quality concerns, APHIS does not anticipate using open air burning to dispose of carcasses. Stationary incinerators are highly efficient and include design features that minimize risks to the environment. However, this equipment is typically only available at hospitals, laboratories, and medical schools. Because of their location, cost, and lack of portability, incineration would not likely be a feasible method of disposal in most situations.

Digesters

Alkaline hydrolysis tissue digesters use sodium hydroxide or potassium hydroxide as an agent that, under heat and pressure, digests carcass tissue, leaving only liquid effluent and the mineral portion of bone and teeth. The effluent has a pH level ranging from 11.4 to 11.7 and, therefore, in most cases, can be discharged into municipal sewage systems. If potassium hydroxide is used, the effluent can be dehydrated and used as fertilizer. The bone and teeth can be crushed into a fine powder and sent to a landfill (USDA 2005).

Anaerobic digestion involves the transformation of organic matter by a mixed culture bacterial ecosystem without oxygen. It is a natural process that produces a gas principally composed of methane and carbon dioxide. The end products of anaerobic digestion are typically biosolids, methane, and liquor (which can be used as a liquid fertilizer). If the end products of anaerobic digestion (biosolids) are applied to the land without pathogens being sufficiently reduced, the pathogens may pose a risk of contamination. Among the advantages of anaerobic digestion are that methane production can be used in place of fossil fuels, well suited for large-scale operations, and end products may be used as fertilizer. However, several disadvantages also exist including complexities and problems associated with sludge management and disposal, significant consumption of water, and the process does not destroy all pathogens (e.g., prions and thermo resistant bacteria) (NABCC 2004).

Rendering

Rendering of carcasses involves the conversion of carcasses into three end products (i.e., carcass meal, melted fat or tallow, and water) using mechanical processes (e.g., grinding, mixing, pressing, decanting, and separating), thermal processes (e.g., cooling, evaporating, and drying), and sometimes chemical processes (e.g., solvent extraction). The main carcass rendering processes include size reduction followed by cooking and separation of fat, water, and protein materials using techniques such as screening, pressing, sequential centrifugation, solvent extraction, and drying. Resulting carcass meal can sometimes be used as an animal feed ingredient, or may be used as fertilizer (NABCC 2004). However, rendering facilities which can accept dead animals are not always readily available (USDA 2005), and rendering cannot be used to dispose of swine that are removed using lead ammunition or those chemically euthanized.

## F. Alternatives and Methods Considered but Dismissed from Detailed Analysis

Several alternatives were dismissed from detailed analysis because they did not meet all four of the criteria for alternatives development as discussed in Section B. Additionally, several methods were removed from further analysis because they were considered to not be reasonably efficient, feasible, or cost-effective methods for FSDM.

### 1. Alternatives Dismissed from Detailed Analysis

#### *a. Exclusive Use of Private Industry, Volunteers, and Private Hunting*

This alternative is similar to Alternative 5 in that APHIS would essentially become a contracting agency which arranged with non-government entities to conduct FSDM. Extensive resources would be needed at the APHIS National and state program level to administer and monitor the program and use of federal resources, leaving substantially less funding for operational management. Some disease monitoring and work to address international feral swine issues would not occur. This alternative would not meet the objectives established in Chapter 1 including international coordination and development of interagency partnerships and, therefore, will not be addressed in detail.

#### *b. No APHIS Involvement in Feral Swine Damage Management*

Under this alternative, APHIS would discontinue all FSDM work, including that requested and paid for by cooperators. Executive Order 13112 - Invasive Species directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. The APHIS-WS program is authorized by law to protect American agriculture and other resources from damage associated with wildlife and (Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426–426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329–331, 7 U.S.C. 426c). APHIS-WS already receives numerous requests from agency partners, Tribes, and private entities for assistance with FSDM. APHIS-VS has additional responsibilities for the protection of livestock and domestic animals under the Animal Health Protection Act (7 U.S.C. 109.8301), which authorizes the Secretary of Agriculture to restrict the movement or to order the removal of animals to prevent the introduction or dissemination of livestock pests or diseases. Data presented in this DEIS establish unequivocally that feral swine can and are having adverse impacts on agriculture, natural resources, property and human health and safety in the United States. Furthermore, Congress has acknowledged that feral swine are a harmful and destructive species, and that there is a need for a national FSDM program (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2014, Public Law No. 113-76 2014). Selection of this alternative would not meet the need for action established in the DEIS; would be inconsistent with agency authorizations, mandates, and EO 13112; and would run counter to Congressional direction. Therefore, this alternative will not be analyzed in detail.

#### *c. Eradication of Swine from All Areas of Occurrence*

This alternative would direct all program efforts toward eradication of feral swine wherever they occurred. Eradication is already a program goal in those States, Territories, and Tribes where feral swine populations are new or not well established, and where the States, Territories, and Tribes desire their complete removal. Eradication is not feasible where State, Territory, and Tribal law and management objectives provide for hunting and maintenance of a feral swine population, or where populations are historically well established. Where swine are well established, the number and movement of feral swine combined with vegetative cover, the constraints of current management tools, challenging terrain, access problems, or other obstacles creates diminishing returns and makes eradication infeasible. The obstacles to making this a feasible alternative preclude further analysis of it at this time.

#### *d. Only Use Non-Lethal Methods to Address Feral Swine Problems*

Under this alternative, APHIS-WS would be required to implement only non-lethal methods to resolve damage caused by feral swine. Limits to the efficacy and applicability of current nonlethal methods preclude development of an effective national FSDM strategy which exclusively uses nonlethal methods. Non-lethal harassment methods often have a high rate of habituation after multiple applications (Gilsdorf et al. 2003, Shivik 2004). To lessen habituation, non-lethal harassment and dispersal techniques require application only when feral swine are present, which can lead to elevated costs from increased monitoring of vulnerable resources.

Fencing and other exclusion systems can be effective in preventing access to resources in certain circumstances. Exclusion is most effective when applied to small areas to protect high value resources, although they have been applied to larger areas such as National Parks when reduction or elimination of the feral swine population on neighboring lands has not been possible or desirable. In these circumstances, use of fencing is initially accompanied by a period of lethal removal of swine within the fenced area. In general, exclusionary methods have limited applicability in protecting human safety, agriculture, or natural resources from feral swine across large areas. There are also concerns regarding the impact of large-scale fencing systems on non-target wildlife.

Currently available nonlethal methods do little to prevent the feral swine population from increasing, although contraceptive methods are under development. Application of this alternative alone would not meet the purpose and need for action. The proposed action, using an IWDM approach, incorporates the use of non-lethal methods. In instances where non-lethal methods would effectively resolve damage from feral swine, they would be recommended for use under the proposed action. Non-lethal methods would be available for use under all alternatives advanced for detailed analysis in this EIS.

***e. Only Use Lethal Methods to Address Feral Swine Problems***

Under this alternative, APHIS-WS would not conduct any non-lethal control for feral swine, but would rely solely on lethal FSDM methods. This alternative was eliminated from further analysis because some situations can be resolved effectively through non-lethal means, and be quite cost-effective. For example, fencing in urban areas, can often deter feral swine from entering and damaging resources, and not have a dramatic effect on non-target wildlife. Fencing and exclusion systems can also help to reduce risk of disease transmission between feral swine and domestic livestock. In some situations, APHIS-WS has used non-lethal methods exclusively as an effective means to resolving damage. Further, this alternative does not interface with the overall concept of IWDM, where multiple methods can achieve a desired cumulative effect. It is APHIS-WS' policy that personnel apply and use the IWDM approach to efficiently and effectively prevent or reduce damage caused by wildlife (APHIS-WS Directive 2.105). Restricting the program to lethal methods would likely not be socially acceptable to various agencies, stakeholder groups, and individuals. For feral swine in areas where the eradication of a local population is desirable, most methods used would be lethal. However, APHIS-WS could still use non-lethal control methods to protect sensitive areas while lethal methods were being implemented.

## 2. Methods Dismissed

### *a. Bounty System*

Bounty systems involve the payment of funds (bounties) for killing animals considered "undesirable" and are usually proposed as a means of reducing or eliminating animal populations. APHIS does not support bounty payments because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective at controlling damage over a wide area, such as across an entire State. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring or were not domestic swine. For example, in a costly bounty program at a military base in Georgia, there were reports that people submitted false evidence of take by turning in tails from meat processing plants (Holtfreter et al. 2009, unpublished report). In some situations, bounty programs may be counterproductive as they provide an incentive for some individuals to maintain swine populations and use bounties as a source of constant income (Weeks and Packard 2009). Bounty programs can provide some benefit by increasing public awareness (Bevins 2014). Nonetheless, bounties can become a costly endeavor, not provide relief, or even worsen the problem. In Queensland, Australia, a 31-year long bounty payment program to remove feral swine did not reduce the population (Woodall 1983).

### *b. National Legislative Changes*

The lead and cooperating Federal agencies continue to review possibilities for national level legislation to address feral swine damage. Challenges which must be considered include the limits to existing agency regulatory authority; State, Territorial, Tribal, and local opposition to Federal regulation; the difficulty in creating national regulation responsive to local needs; and the resources needed to enforce regulations. Review of existing regulations indicates that the agencies are struggling to enforce the regulations currently available; adding additional regulations would require a substantial portion of funds available for damage management. Based on these considerations, the agencies have determined that the most effective regulatory strategy is to work with State, Territorial, and Tribal agencies to develop effective regulations which are suited to their local needs. There are no changes in Federal legislation planned at this time.

### *c. Diversionary Feeding*

This method involves using supplemental food plots or bait stations to lure feral swine away from areas and resources where damage is occurring. This alternative is inefficient at best, and would most likely lead indirectly to increased damage.

Supplemental feeding could increase damage in two ways. First, feral swine may be attracted to areas that they would not (or not as frequently) visit if no food were provided. Second, due to the likely proximity of agricultural lands to supplemental feeding sites, feral swine may visit and damage crops more (rather than less) often than in the absence of supplemental food (Geiser and Reyer 2004). Further, diversionary feeding does not hinder their ability and propensity to wander to other locations where they can cause damage.

To remain effective, supplementary food must be available throughout the period when the resource (e.g., crop) is vulnerable, which makes this method expensive in terms of staff and resources (Vassant et al. 1987). Additionally, the abundant food supply provided by supplemental feeding may be counterproductive to feral swine population management by enhancing population growth through improved survival and reproductive output (Groot Bruinderink et al. 1994).

Currently, there are no repellents registered for use with feral swine in the United States. Should new technologies be developed that demonstrate promise, the use of repellants could be explored as part of an IWDM effort.

***e. Export Swine to Other Countries***

As discussed in Section F.11 on the disposition of feral swine, there are many criteria which would need to be met for feral swine to be safely used as human food on a commercial scale. These logistical obstacles would also apply to feral swine intended for export to other countries. Additionally, feral swine intended for export would be subject to testing and certification requirements and inspections in the destination country. Consequently, implementation of this alternative was determined to be too costly and logistically difficult, and will not be considered further.

***f. Donation to Zoos and Animal Sanctuaries***

Many zoos and wildlife sanctuaries accept donations of non-chemically euthanized animals. Feral swine that meet these criteria could be donated for animal consumption at such facilities. However, feral swine are known to carry a number of diseases which may be transmitted to other animals through consumption of carcasses (e.g., trichonella) and many facilities may be unwilling to accept feral swine donations due to the risk of disease transmission. The testing necessary to ensure that carcasses could be safely used is unlikely to be cost effective. Therefore, this method will not be considered in detail.

## G. Standard Operating Procedures Common to all Alternatives except the Federal FSDM Grant Program

Standard Operating Procedures (SOPs) are built into APHIS alternatives as applicable, and serve to improve the safety, selectivity, and efficacy of activities intended to resolve wildlife damage. SOPs are incorporated into the Current APHIS-WS FSDM Program whether it involves technical assistance, direct control, or both. Additional measures may be added to the list below, based on site-specific needs and depending upon unique local circumstances. For example, specific measures to protect resources (i.e., sensitive species) would be added to local- or State-level APHIS-WS programs based on consultations or coordination with Federal, State, Territorial, Tribal or local resource management agencies. Similarly, coordination with land management agencies would likely result in additional measures to avoid conflicts with agency policy, legislative directives, and land use management plans.

Under the Federal FSDM Grant Program (Alternative 5), grant recipients would be expected to comply with the primary SOPs included here. However, APHIS would have limited capacity to monitor for compliance with these measures.

### 1. General SOPs Used by APHIS-WS in Operational Activity

- The APHIS-WS Decision Model (Slate et al. 1992, Figure 2-1) is used to identify the most appropriate strategies for FSDM on a case-by-case basis. APHIS-trained wildlife specialists consider multiple variables specific to the project site before selecting the appropriate techniques. Legal and practical restrictions on the use of methods, considerations for human safety and risks to non-target animals, weather, vegetation density, and terrain are just some of the variables that would be considered in this model.

### 2. SOPs on Program Monitoring and Compliance

- APHIS-WS monitors and reports the lethal removal of all feral swine through its Management Information System (MIS) database[7]. This information is available to feral swine management agencies, and can be used to help evaluate population trends and the magnitude of take in each State.

- FSDM activities are evaluated prior to the start of work and monitored annually to ensure that they fall within the scope and limits of NEPA analyses and associated decisions including state and local level analyses. NEPA analyses will be updated or supplemented as necessary.

[7] MIS Database information - http://www.aphis.usda.gov/wildlife_damage/directives/4.205_reporting.pdf

- APHIS-WS complies with all applicable laws and regulations that pertain to conducting FSDM on Federal, State, Tribal, local, and private lands.

- APHIS-WS personnel adhere to all label requirements for use, storage, and disposal of chemical toxicants, repellents, and immobilization, euthanasia, and contraceptive drugs. EPA/FDA-approved labels provide information on preventing exposure to people, pets, and T&E species, along with environmental considerations that must be followed. APHIS-WS personnel abide by these. These restrictions preclude or reduce exposure to non-target species, the public, pets, and the environment.

- APHIS-WS Specialists who use firearms and pyrotechnics are trained and certified by experts in the safe and effective use of these methods.

- Training and certification is required of pilots and crew members for aerial shooting projects. This training includes training in the use of personal protective equipment, emergency procedures in the event of an aerial accident, target identification, and additional firearms training specific to aircraft. Commercial-rated pilots must pass a Class II physical exam, as defined by the Federal Aviation Administration, and are subjected to recurrent APHIS-WS safety training for low-level aircraft. Aircraft are inspected to meet or exceed Part 135 Federal Aviation Administration aircraft standards.

### 3. SOPs to Minimize Harm to Non-Target Species

- APHIS-WS monitors the impacts of program actions on non-target species (e.g., dispersed, captured and released, killed) to determine if program impacts are within parameters anticipated and analyzed in applicable national, state, or local NEPA analyses. This information is available to applicable wildlife management agencies and can be used to help evaluate impacts of program actions on non-target species.

- APHIS-WS Specialists use specific trap types, trap door systems and trigger devices, baits, lures and device placement that are most conducive for capturing the targeted animals and minimizing the potential capture of non-target animals.

- APHIS-WS specialists confirm identification of the target animal prior to shooting.

- Where appropriate, suppressed firearms would be used to minimize noise and disturbance.

- When conducting nighttime activities, potential impacts associated with spotlights may be minimized by the use of night vision equipment, infrared devices, or red filtered spotlights.

- Non-target animals captured in cage traps or any other restraining device would be released whenever it is possible and safe to do so.

- Traps would be checked, in accordance with applicable State laws, to ensure non-target species would be released in a timely manner, and to minimize unnecessary stress or injury to target or non-target species.

- Human presence at sites would be kept to the minimal time needed to accomplish the management action.

- Trap monitoring devices may be employed where applicable to facilitate monitoring of the status of traps in remote locations, reduce risks to non-target species, and to ensure any captured wildlife was removed promptly to minimize stress and injury.

- APHIS-WS personnel work with research programs, such as NWRC, to continually improve and refine the selectivity of management devices, thereby reducing non-target take.

- APHIS-WS will use non-toxic ammunition on National Parks and FWS wildlife refuges, as required by land management policies, and as required by State law. On other lands, APHIS-WS will exhaust the available supply of effective lead-free ammunition for aerial operations when possible before resorting to ammunition containing lead. For ground operations, APHIS will work to transition from lead to lead-free ammunition within the constraints of availability, performance, and safety.

**4. SOPs that Minimize Harm to T&E Species**

In addition to SOPs that minimize harm to non-target species, APHIS-WS would implement specific measures, as requested by the FWS during the consultation process, to comply with Section 7 of the Endangered Species Act:

- Before any FSDM actions that may affect federally listed T&E species could be implemented, a formal or informal consultation with FWS and/or National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries Service (NMFS), as appropriate, would be completed.

- Reasonable and prudent Alternatives, Measures, and Terms and Conditions associated with formal ESA Section 7 consultations are incorporated into local program planning.

- Minimization measures identified in specific informal ESA consultations with FWS and/or NMFS, as applicable, are incorporated into State and local programs for FSDM.

- APHIS-WS will use non-toxic ammunition when and where required by ESA Section 7 consultations.

- APHIS would not proceed with any action that the FWS has determined could jeopardize the continued existence of any federally listed threatened or endangered species, or that would adversely modify or destroy designated critical habitat.

### 5. SOPs that Minimize the Potential for Non-purposeful Take of Eagles

- All projects proposed for implementation at the State, Territory, Tribal or local level will be reviewed for potential to take[8] eagles in accordance with the provisions of the Bald and Golden Eagle Protection Act (BGEPA). If potential risk of take is identified, APHIS-WS will work with the FWS on measures to reduce risks and the need for a non-purposeful take permit.

- Eagles are known to scavenge on carcasses. APHIS-WS would not intentionally use carcasses to draw feral swine to foot-hold traps or snares, but carcasses (e.g., road kill, predation, wildlife damage management) could be near project sites. To reduce risks of unintentional capture of an eagle in a snare or foot-hold trap, WS Directive 2.45 states that no foot-hold traps or snares (cable devices) will be set closer than 30 feet from any exposed animal carcass or part thereof, having meat or viscera attached that may attract raptors or other non-target animals. If an animal carcass could be dragged or moved by scavengers to within 30 feet of set foot-hold traps, snares (cable device); the carcass will be secured to restrict movement.

### 6. SOPs on Carcass Disposal

- Carcasses of feral swine retrieved by APHIS-WS after damage management activities would be disposed of in accordance with APHIS-WS Directive 2.515.

- If APHIS-WS is directly involved in carcass burial, burial site remediation should include soil conservation measures to minimize runoff and soil erosion, loss of topsoil and effects on vegetation.

- On non-federal lands, when APHIS-WS is directly involved in carcass burial, siting decisions would be made after consulting with State Historic Preservation Officers (SHPOs), affected tribal authorities, and land managers to avoid adverse effects on cultural/historic resources.

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[8] The Bald and Golden Eagle Protection Act defines "Take" as "*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb*." Disturb is defined as any activity that can result in injury to an eagle, or cause nest abandonment or decrease in productivity by impacting breeding, feeding, or sheltering behavior.

- When more than one sounder requires burial per site and there are not specific rules for feral swine burial, APHIS-WS operational programs that bury feral swine carcasses, or that advise landowners or land managers about on-site burial, should consult with local resource experts and/or follow/recommend local routine livestock burial rules or guidelines to help minimize adverse effects on soils and water quality.

- Open air burning of feral swine carcasses would be avoided (APHIS-WS Directive 2.515) except when this method is required by regulations and can be conducted safely.

**7. SOPs that Minimize Risks to Human Safety**

- Conspicuous warning signs, alerting people to the presence of foot-hold traps or snares will be posted on main entrances or commonly used access points to areas where foot-hold traps snares are in use. Signs will be routinely checked to assure they are present, obvious, and readable.

- Whenever possible, FSDM activities would be conducted away from areas of high human activity. If this is not possible, APHIS-WS personnel would work to schedule activities during periods when human activity was low (e.g., early morning or late at night) or may work with the landowner/manager to temporarily close areas during FSDM. Signs would be placed to warn the public of any potential hazards as appropriate.

- Shooting would be conducted during times and in locations where risks to the public may be eliminated (e.g., site is closed to public).

- Personnel involved in shooting operations would be fully trained in the proper and safe application of this method in accordance with APHIS-WS Directive 2.615.

- Aviation safety and the operation of aircraft would adhere to standards for the use of aircraft in APHIS-WS' activities under APHIS-WS Directive 2.620.

- All pilots, crewmembers, ground crews, and aircraft maintenance personnel would adhere to the APHIS-WS Aviation Operations and Safety Manual, as amended, as well as, Title 14 CFR, and FAR, Part 43, 61, 91, 119, 133, 135, and 137.

- Personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by APHIS-WS would be securely stored and properly monitored to ensure the safety of the public. APHIS-WS' use of chemicals and training requirements to use those chemicals are outlined in APHIS-WS Directive 2.401 and APHIS-WS Directive 2.430.

- All chemical methods used by APHIS-WS or recommended by APHIS-WS would be registered with the FDA, DEA, EPA, and the appropriate State or Tribal regulatory agency(ies).

- In most cases, captured feral swine would be killed. In cases where feral swine would be chemically immobilized, fitted with radio telemetry equipment, and released for research or operational purposes, released animals would be identified with ear tags or other similar devices that provide APHIS-WS' contact information and a warning to the public not to capture, kill, or eat the marked animal. APHIS-WS would adhere to all established withdrawal times for feral swine when using immobilizing drugs for the capture of feral swine that are agreed upon by APHIS-WS, State regulatory agencies, and veterinary authorities.

- When allowed by law and when landowners prefer to retain feral swine carcass(es) killed on the property for personal use, APHIS-WS provides information about food safety and the safe handling of the carcass to reduce risks. Therefore risks to human safety are minimized by emphasizing precautions for safe handling and preparation/consumption. In addition, landowners are advised not to feed pets or other animals uncooked meat or other carcass products.

**8. SOPs that Minimize Harm to Cultural Resources**

- Before any FSDM actions that may affect cultural resources protected by the NHPA could be implemented, consultations with Federal, State, Territorial, and Tribal historic preservation offices, as appropriate, would be conducted to prevent, minimize, or mitigate potential impacts to cultural resources.

- If an individual activity with the potential to affect archaeological resources is planned under the alternative selected in this DEIS, APHIS-WS will comply with the provisions set forth in the Archaeological Resources Protection Act (ARPA) of 1979.

- On public lands and on other federal lands, the land management agency requesting feral swine control could be designated as the lead agency for compliance with Section 106, and APHIS would cooperate in that effort.

**9. SOPs that Address Animal Welfare Concerns**

- Personnel would be well trained in the latest and most humane devices/methods for removing feral swine.

- APHIS-WS' personnel would attempt to kill captured feral swine as quickly and humanely as possible, in accordance with APHIS-WS' directives (APHIS-WS Directive 2.430, APHIS-WS Directive 2.505), and applicable AVMA euthanasia guidelines for use on wildlife under field conditions (AVMA 2013).

- NWRC is continually conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

**10. SOPs that Address Coordination within States and Territories**

- States and Territories would be involved in the planning and prioritization of FSDM in areas under their jurisdiction to ensure that all actions are conducted in accordance with State or Territorial management objectives for the species.

- States and Territories animal health agencies will be apprised of feral swine disease monitoring activities and projects occurring in their state or territory.

- All FSDM activities would be conducted in accordance with applicable State and Territorial regulations.

- APHIS will consult with State and Territorial agencies regarding the impacts of proposed methods on State, Territory and Tribally-listed T&E species. APHIS will work with State, Territorial and Tribal entities on methods to ensure that FSDM actions do not jeopardize State, Territory or tribally listed T&E species.

**11. SOPs that Address Coordination with Tribes**

- Tribes would be included in the planning and prioritization of FSDM activities that occur in areas under their jurisdiction to ensure that all actions are conducted in accordance with Tribal objectives for the species.

- No FSDM would be conducted on Tribal lands without the written consent of the Tribe.

- All FSDM activities conducted on Tribal lands would be conducted in accordance with applicable Tribal regulations.

- APHIS will consult with Tribes regarding the impacts of proposed methods on tribally-listed T&E species. APHIS will work with Tribes on methods to ensure that FSDM actions do not jeopardize tribally listed T&E species.

- APHIS will remain open to consultation with Tribes regarding FSDM in accordance with APHIS Directive 1040.3.

## 12. SOPs that Address Actions Conducted on Federal Lands

- Except as otherwise provided under Memoranda of Understanding, FSDM conducted on lands administered by the National Park Service, U.S. Fish and Wildlife Service, Department of Defense agencies, and other federal lands would be at the request of the federal land management agency and in accordance with agreed upon conditions for minimizing adverse effects on land uses and other resources (e.g., requirements for lead-free ammunition, trap placement).

- The federal land management agency would be consulted prior to conducting FSDM to ensure consistency with applicable land and resource management plans, Congressional direction regarding the intended purpose of the site, and existing site uses.

- All FSDM conducted on federal lands must be reviewed for consistency with applicable land and resource management plans, Congressional direction regarding the intended purpose of the site, and existing site uses.

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# Chapter 3: Affected Environment

The affected environment for this analysis includes those aspects of the human environment that are impacted by feral swine and impacts on the environment that may result from implementation of the proposed FSDM methods. This Chapter provides a detailed review of the adverse impacts of feral swine that we introduced as the Need for Action (Chapter 1, Section D), but also addresses the positive impacts associated with feral swine. Components of the affected environment which may be impacted by FSDM are also addressed.

## A. Feral Swine

### 1. Origin and Morphology of Feral Swine in the United States and Territories

**S**wine are not native to the United States or the Territories. It is commonly thought that the first domestic swine were introduced into areas which eventually became part of the United States by Polynesians that settled in Hawaii over 1,000 years ago (Nogueira et al. 2007). The Polynesian swine were most likely descendants of the Asiatic form of swine (*Sus scrofa* ; Nogueira et al. 2007). Captain James Cook, a British explorer, observed that the existing swine on the Hawaiian Islands were small in size, black in color, and weighed about 50 to 60 pounds (Baker 1975). During his explorations, Cook brought European swine to the Islands (Nogueira et al. 2007). The European swine were larger than the Asiatic swine (Baker 1975, Nogueira et al. 2007). Early reports state that the Asiatic form was replaced by the European breeds. However, more recent DNA analysis has indicated that Hawaiian feral swine are more genetically similar to Indonesian/Polynesian swine and not the European swine (Nogueira et al. 2007).

Feral swine are also found within the U.S. territories of Guam, Northern Mariana Islands, American Samoa, Virgin Islands, and Puerto Rico. However, there are limited primary sources of information for when and how these animals were transported to these islands. Polynesians settled American Samoa approximately 3,000 years ago and brought domestic swine with them (American Samoa Historic Preservation Office 2014). Similar to the mainland, these animals became feral when they escaped confinement or were released to range freely in areas adjacent to settlements. Spanish settlers introduced domestic swine to NMI between 1672 and 1685 (Conry 1988). It is thought that initially, the swine came from domestic Philippian herds (Conry 1988). By 1772 there was an established feral population, which was abundant by the time the American administrative period began in the early 1900s (Conry 1988).

Feral swine in the Virgin Islands and Puerto Rico are likely descended from domestic European swine. Danish settlers are thought to have brought feral swine to St. Johns, one of the three islands that make up the U.S. Virgin Islands, in 1718 when they colonized the island (NPS 2003). The swine have established breeding populations in all habitat types within Virgin Islands National Park (NPS 2003). One source cites that in the 16th century, Christopher Newport landed on Mona Island, one of the islands of Puerto Rico, and found 19 people raising pigs (Cintron 2011). The same source indicates that by the 17th and 18th centuries, the only surviving remnants of previous colonization on Mona Island were the goats and pigs that had become feral (Cintron 2011).

The first documented mainland introduction of domestic swine was in Florida by Hernando de Soto, a Spanish explorer (Giuliano 2010, Mayer and Brisbin 1991). However, the first introduction may have actually occurred during a failed expedition by Juan Ponce de Leon (Mayer 2009*c*). During his second expedition, he brought several species of livestock, including pigs, with the plan of establishing a settlement in Florida as a base to further explore the region. The expedition was attacked by local Indians shortly after landfall and several members wounded. It is unclear as to whether the animals were actually released at the site. Introductions of swine were then made in Texas in the 1680s (Mapston 2010) and the Carolinas and Georgia around the same time (Wood and Barrett 1979). The California Department of Fish and Wildlife indicates that Spanish and Russian settlers introduced domestic swine to California in the 1700's (CDFW 2014). The domestic swine in the areas became feral when they escaped confinement or were released into open ranges (Giuliano 2010), which was a normal farming practice at the time.

The Eurasian wild boar, native to Europe and Asia, were introduced throughout the U.S. mainland primarily during the 1900s (New Hampshire in 1886, New York in 1900, North Carolina/Tennessee in 1912, Texas in 1919, and Washington in 1981; Giuliano 2010) to provide hunting opportunities. In the 1920's, a landowner introduced the European wild boar into California (CDFW 2014). Wild boar were introduced to provide new game to hunt and to increase the sporting value of feral hogs through hybridization (Giuliano 2010, Mayer and Brisbin 1993). In most places where the domestic feral swine and Eurasian wild boar populations overlap in their distribution, hybridization occurs (Mayer and Brisbin 1993, Giuliano 2010, CDFW 2014).

It is sometimes difficult to visually distinguish between Eurasian boars, feral domestic swine, and their hybrids because each subspecies can be very diverse in its physical appearance. In general, domestic swine that become feral still resemble domestic swine but they are usually leaner. They also have more developed shoulders, longer and larger snouts and tusks, smaller ears, longer, coarser hair, and straighter tails with a bushy tip (Mapston, 2010). Some feral swine develop a mane of hair on their necks and backs that can be raised when they are angered, hence, the nickname "razorback" (Mapston 2010). Males have an area along their shoulders called the shield, that has tough skin, cartilage, and scar tissue which develops as the animal ages and fights (Mapston 2010). Striped patterns are visible in all types of juveniles, but disappear as the hog matures (Mapston 2010).

Eurasian wild boars are slightly taller than feral swine, typically have longer hair, appear leaner, have larger heads, longer snouts, shorter and straighter tails, and smaller, more upright ears (Giuliano 2010, Mapston 2010). Most have large prominent tusks (Mayer and Brisbin 1993). Other differences are outlined on the Table 3-1 below.

**Table 3-1.** Comparison of the identifying morphological characters used to determine the three primary types of wild swine found in the United States. This comparison is for adult animals only (Mayer and Brisbin 1993).

| Morphological Character | Eurasian Wild Boar | Wild Boar/Feral Hog Hybrids | Feral Hog |
|---|---|---|---|
| Skull | Determined by Analysis of Skull Measurements | | |
| External Body Dimensions | Determined by Analysis of External Body Measurements | | |
| Coat Coloration Patterns | Light-tipped/brown-base bristles over most of the body with dark brown to black solid-colored points[a]; white-tipped facial pattern (saddle or mouth streak) | Include wild boar and feral hog colorations in pure form or combinations of the parental stock patterns | Combinations of black, white and red/brown; can include solid or mottled patterns; white points and belting also observed |
| Bristle Coloration | Light to Dark Brown bristles with white to cream/buff tips | Solid-colored and light-tipped/dark-based bristles | Solid-colored bristles |
| Underfur Coloration | Color variable (e.g., cream to smoke gray) but typically different from the base coloration of the bristles | Color variable; color can be the same or different from the bristles in the same area of the pelage | Color variable but same as the bristles in the same area of the pelage |
| Other Morphological Structures | No neck wattles or syndactylous digits | Neck wattles or syndactylous digits can be present | Neck wattles or syndactylous digits can be present |
| [a] The "points" include the ends of the snout, legs, tail, and the entire pinnae of the ears. | | | |

## 2. Population Status of Feral Swine

Chapter 1, Figure 1 shows the distribution of feral swine in North America. Feral swine are also known to have established populations in portions of Hawaii, American Samoa, NMI, Virgin Islands, Guam, and Puerto Rico. Knowledge about swine distribution and population size changes frequently as awareness of the damage and risks associated with feral swine grows and agencies become increasingly involved in feral swine management efforts. Figure 2-2 classifies states into rough categories based on data and general opinions of natural resource managers (State Wildlife and Agriculture Departments, and APHIS-WS staff) regarding population size. While most agencies are aware of areas where swine occur in their jurisdiction, most states and Territories do not have sufficiently detailed information to feel comfortable providing a detailed estimate of the number of swine in their area (Appendix D, Table 2), although at least one author has endeavored to develop a national population estimate using existing information.

No consistent method of monitoring and estimating feral swine is implemented by the states. Efforts to quantify feral swine populations are complicated by several factors including swine behavior, agency financial constraints, and available methodology (Engeman et al. 2013a). Feral swine often prefer areas of heavy vegetation cover which complicates visual surveys. Additionally, swine subjected to hunting pressure and damage management removal efforts often become increasingly secretive and wary of humans and shift primary activity patterns from daytime to evenings. Agency budgets are limited and there is considerable competition for resources that might be used to manage and monitor feral swine populations. Management of invasive species often has lower priority than native species preservation and management. Similarly, routine inspections of fenced swine hunting facilities, and investigations of feral swine sightings may have lower priority as responses to more immediate threats to trade and the agricultural industry such as the Porcine Epidemic Diarrhea Virus (PEDV; AASV 2013).

Despite existing limitations, two systems for monitoring the national feral swine population are available. The Southeastern Cooperative Wildlife Disease Study (SCWDS) started producing nationwide feral swine distribution maps in 1982. Populations are only considered established and recorded on the maps if the population has been present for 2 or more years or there is evidence of reproduction. Data for the maps is provided by APHIS-WS, State and Territorial natural resource and agriculture agencies and other state and federal agencies involved in natural resources management (Figure 1-1). The mapping system has the advantage of providing a standardized method for monitoring the feral swine population over time, but it does not provide information on the number of swine present.

A system for estimating the number of animals in the national feral swine population has been developed by J. J. Mayer with the Savannah River National Laboratory in Aiken, South Carolina (Mayer 2014). The system uses available information to provide an estimate of the feral swine population in each of the states where feral swine occur. When available, population estimates reported by either an agency (e.g., state or federal) or an academic or extension researcher for the state in question were used. Sources for the estimates include journal publications or other reports, official web sites, quotes from secondary sources (e.g., news media), or personal reports to the author. Some states collect data on swine taken by hunters. When these data are available, feral swine populations are estimated using an assumption of a 23% harvest rate, based on information in the literature. Neither population estimates nor hunting data are available in some states, but the states have reported the presence of these animals. These reports include informal or anecdotal estimates of the numbers of feral swine present (e.g., included numbers present or population sizes such as “a few,” “a couple of dozen,” “45 or fewer,” or “several hundred.”). None of these casual estimates involved large numbers of animals (e.g., thousands of wild pigs) and in some cases the occurrence of these animals may have been temporary or even questionable (i.e., there may in fact be no wild pigs left in the area). To account for the lack of information on feral swine in these states, the author used a system of "bounding" estimates to encompass the numbers associated with the presence of these animals in those states. Data available to Mayer as of May 2014 yielded a mean national population estimate of 6.3 million swine (range 4.4 – 11.3million animals; Table 3-2). The advantage of a numeric system is that it provides an indication of the scale of the problem, and, given that damage and conflicts are related to population size, the magnitude of the conflicts and ecosystem impacts of feral swine. Unfortunately, the lack of consistent population monitoring in states makes it difficult to accurately monitor changes in the population over time.

**Table 3-2**. Estimated size of the wild pig population in the United States in 2014 (J. Mayer, Savannah River National Laboratory, Aiken, S.C., unpublished data).

| | Population Estimate | | | Estimate Basis/Bases | | |
|---|---|---|---|---|---|---|
| **State** | **Minimum** | **Mean** | **Maximum** | **Published or Reported** | **Harvest Percentage** | **Bounding Estimate** |
| Alabama | 90,000 | 195,000 | 300,000 | | X | |
| Alaska | 0 | 0 | 0 | X | | |
| Arizona | 200 | 400 | 600 | | | X |
| Arkansas | 60,000 | 130,000 | 200,000 | | X | |
| California | 70,000 | 110,000 | 275,000 | | X | |
| Colorado | 100 | 200 | 400 | | | X |
| Connecticut | 0 | 0 | 0 | X | | |
| Delaware | 0 | 0 | 0 | X | | |
| Florida | 500,000 | 750,000[a] | 1,000,000 | X | | |
| Georgia | 600,000 | 1,000,000 | 2,700,000 | | X | |
| Hawaii | 10,000 | 16,000 | 40,000 | | X | |
| Idaho | 0 | 25 | 50 | | | X |
| Illinois | 0 | 40 | 80 | | | X |
| Indiana | 3,000 | 3,000 | 3,000 | X | | |
| Iowa | 25 | 40 | 100 | | X | |
| Kansas | 500 | 750[a] | 1,000 | X | | |
| Kentucky | 1,000 | 1,000 | 1,000 | X | | |
| Louisiana | 500,000 | 500,000 | 500,000 | X | | |
| Maine | 0 | 5 | 10 | | | X |
| Maryland | 0 | 0 | 0 | X | | |
| Massachusetts | 0 | 0 | 0 | X | | |
| Michigan | 1,000 | 2,000[a] | 3,000 | X | | |
| Minnesota | 0 | 0 | 0 | X | | |
| Mississippi | 190,000 | 300,000 | 800,000 | | X | |
| Missouri | 10,000 | 10,000 | 10,000 | X | | |
| Montana | 0 | 0 | 0 | X | | |
| Nebraska | 0 | 0 | 0 | X | | |

| State | Population Estimate | | | Estimate Basis/Bases | | |
|---|---|---|---|---|---|---|
| | Minimum | Mean | Maximum | Published or Reported | Harvest Percentage | Bounding Estimate |
| Nevada | 200 | 250 | 300 | | | X |
| New Hampshire | 500 | 500 | 500 | X | | |
| New Jersey | 0 | 40 | 80 | | | X |
| New Mexico | 500 | 750 | 1,000 | | | X |
| New York | 100 | 150 | 200 | | | X |
| North Carolina | 1,000 | 1,500 [a] | 2,000 | X | | |
| North Dakota | 0 | 50 | 100 | | | X |
| Ohio | 1,000 | 1,000 | 1,000 | X | | |
| Oklahoma | 430,000 | 500,000 | 1,600,000 | X | | |
| Oregon | 1,000 | 3,000 [a] | 5,000 | X | | |
| Pennsylvania | 2,000 | 2,500 [a] | 3,000 | X | | |
| Rhode Island | 0 | 0 | 0 | X | | |
| South Carolina | 95,000 | 160,000 | 400,000 | | X | |
| South Dakota | 0 | 0 | 0 | X | | |
| Tennessee | 1,000 | 1,500 [a] | 2,000 | X | | |
| Texas | 1,800,000 | 2,600,000 | 3,400,000 | X | | |
| Utah | 50 | 75 | 100 | | | X |
| Vermont | 0 | 0 | 0 | X | | |
| Virginia | 2,000 | 3,000 | 4,000 | X | | |
| Washington | 0 | 0 | 0 | X | | |
| West Virginia | 140 | 200 | 360 | | X | |
| Wisconsin | 100 | 100 | 100 | X | | |
| Wyoming | 0 | 0 | 0 | X | | |
| **Totals** | **4,370,415** | **6,293,075** | **11,253,980** | **30** | **9** | **11** |

## 3. Behavior of Feral Swine

### *a. Social Structure*

Feral swine are typically found in groups called sounders. The size of the sounders may vary depending on the season, region, predation, and/or the biological cycle of the animal (Mapston 2010, Fernandez-Llario et al. 1996, Mayer 2009c). Sounders are composed of two or more individuals which are generally related females, and usually have about 9 or 10 (Mapston 2010, Graves 1984, Nogueria et al. 2007). However, during a dry season or drought some sounders may have up to 40 or 50 animals (Mapston 2010). Sounders are typically comprised of a sow and her litter (Mayer, 2009) or several females and their offspring (Graves 1984) although groups of adults or subadults are possible. Other individuals may be “loosely associated” with sounders, for example boars may associate with females when they are sexually receptive (Graves 1984). Weaned female swine generally remain with their natal group, although some females are known to disperse and form groups with siblings (Kaminski et al. 2005, Spencer et al. 2005, Lapidge et al. 2004). Males are usually solitary, except when found in breeding groups (Mayer 2009*c*, Mapston, 2010).

Data from Georgia (Sparklin et al 2009) on movements of female feral swine indicated that sounders had nearly exclusive home ranges and completely exclusive core movement areas. This information combined with behavior observations was indicative of territorial behavior by sounders. Pigs within sounders are likely to exclude immigrants until the sounder is reduced to the point where new individuals can invade (Sparklin et al. 2005). Genetic studies have shown multiple paternities within family groups, including offspring of males which are not part of the family group (Mayer 2009*c*). However, dispersal rates are likely to be greater than those indicated by genetic analysis (Spencer et al 2005). Using a multidisciplinary approach, Spencer et al. (2005) studied the social structure of a controlled population of feral swine in Australia. Generally, the Australian swine groups were comprised of related individuals, at the level of first-cousin relatives. However, the study suggested that females will accept multiple matings, females form loose groups that appear to be highly dynamic, males will travel large distances between the units, and the unit will form a single open (unfenced) population with no evidence of genetic structuring. Giffin (1978) suggested that Hawaiian feral swine units consisted of both related and unrelated swine grouped temporarily; while the usual group consisted of one or two sows and their offspring.

Feral swine have poor vision (Nogueira et al. 2007) and excellent senses of hearing and smell (Mapston 2010). Consequently sound and odor cues are the primary means of communication. They have a variety of calls, including an alarm grunt given by the first swine that senses an intruder (Giuliano 2010). Feral swine also communicate by scratching and rubbing their bodies on posts that other swine and animals can smell (Giuliano 2010). They use tusks to scrape the bark of trees which may indicate dominance and/or territorial claims (Baker 1975, Giuliano 2010).

### *b. Use of Habitat*

One of the reasons swine have historically been a popular livestock animal is because of their ability to survive in various environments. Feral swine are generalists when it comes to habitat selection, and are highly adaptable to their environment. They can tolerate a range of climates, they are largely indiscriminate in their food selection, and there are claims they can live a day’s walk from water (Mississippi State University 2014).

In undisturbed areas, feral swine are largely diurnal (Mayer 2009b). However, swine appear capable of adjusting their activity patterns in response to human activity. In areas with hunting pressure or high human activity, swine may be primarily nocturnal (Mayer 2009b, Mapston 2010). Daily activities of feral swine are also influenced by temperature (Mayer 2009b, Hellgren 2014). In the summer, feral swine observed in Tennessee feed primarily at night (Singer et al. 1981). In Hawaii, feral swine activity peaks in late afternoon, night, and early morning, suggesting night and afternoon resting periods between resting periods (Nogueira et al. 2007). However, in colder climates, activity increases during daylight hours in the colder portions of the year. Age and sex also influence activity patterns with younger swine moving more often during daytime hours than older swine (Nogueira 2007, Mayer 2009b). Sows may maintain relatively constant activity during active period while males generally may exhibit bursts of activity with prolonged periods of inactivity (Mayer 2009b). However, boars generally travel farther than sows (Nogueira et al. 2007, Mapston 2010).

Individual swine may have overlapping territories, but there is evidence that sounders may be territorial. However, distribution of food resources, may influence territoriality (Sparklin et al. 2009). The size of feral swine's home range can vary greatly depending on habitat quality. For example, Hellgren (2014) reported smaller home ranges in coastal Texan habitats and larger home ranges found in the Rio Grande Plains and the post oak savannah. Home ranges are normally 0.5 to 3 square miles, but can vary from 0.4 to over 19 square miles if food or water is not adequate (Hellgren 2014). In Hawaii, home ranges of boars (2.0 $km^2$) were nearly two times that of sows (1.1 $km^2$); Nogueira et al. 2007). In Georgia, average home ranges for sounders varied from 1.95-3.66 km2 (Sparklin et al. 2009) and were similar to other reports from the southeastern United States. In Mississippi, dry season home ranges (6.4 $km^2$) were larger than wet season ranges (3.0 $km^2$; Hayes et al. 2009).

### *c. Capacity for Learning*

Pigs have well-developed, large brains, and researchers have begun to use domestic swine for cognitive research due to their physiological and anatomical similarities with humans (Gieling et al 2011). *Sus scrofa* have been shown to perform learning and memory tasks, but many results have not been replicated or validated (Gieling et al 2011) so more research is needed. This research is lacking in feral swine; however, there are numerous references in the literature to the intelligence of feral swine. Mayer (2009*c*) describes feral swine as very intelligent and secretive. Feral swine are often seen as intelligent due to observations that the animals may change behaviors due to human presence (Singer et al. 1981) such as shifting their home range or to become more nocturnal when there is intensive hunting (Mapston 2010). Additionally, feral swine have been observed to smell humans from nearly a half mile away and have avoided or jumped over nearby traps (Nogueira 2007). People who work on removing swine have noted the ability of swine to learn and avoid capture devices, hunters, and dogs after prior experience, making removal of the animals increasingly difficult. Consequently, methods which focus on removing entire sounders at one time and which reduce the risk of individual animals escaping and learning to avoid capture systems are preferred.

### *d. Food Habits*

Feral swine are opportunistic omnivores and appear to be able to survive on almost anything edible (Ditchkoff and Mayer 2009, Sweeney et al. 2003). Diet varies throughout the year in accordance with changes in availability of food sources. Feral swine have a simple, non-ruminant stomach which means feral swine are not as efficient in using food items high in cellulose, hemicellulose and some carbohydrates as ruminants such as cattle.

Feral swine obtain food through grazing on above-ground plant material, rooting for below ground food sources, predation and scavenging on carcasses. Depending on soil type (density, moisture level, compaction) swine may root at depths ranging from less than an inch to a yard or more below the surface (Ditchkoff and Mayer 2009).

Vegetation usually comprises the majority (> 85%) of feral swine diets, with the actual amount varying depending on the availability of alternate food sources. Mast (e.g., acorns, beechnuts, chestnuts, hickory nuts) is preferred when it's available and can have substantial impacts on body condition, reproductive potential and movement patterns (West et al. 2009). Because of their high digestibility and concentration of individual plants, agricultural crops can also be a preferred food source (Ditchkoff and Mayer 2009).

Feral swine are also known to consume algae, fungi, invertebrates (e.g., insects, worms, crustaceans), eggs and other animal matter (Ditchkoff and Mayer 2009, West et al. 2009). Feral swine may prey on and/or scavenge carcasses of small animals including reptiles, fish, amphibians, ground-nesting birds, and young of wild game and domestic livestock (Ditchkoff and Mayer 2009, Wilcox and Van Vuren 2009). Evidence of larger animals sometimes is found in feral swine stomachs, and is primarily associated with scavenging carcasses. However, feral swine have been known to prey on adult livestock which are vulnerable when giving birth. Animal matter is a regular but limited portion of feral swine diets. In the U.S., animal matter rarely exceeds 2% but can be as high as 30% or more during periods of animal matter abundance. In one study in (place?), animal matter was found in 94% of feral swine stomachs (Ballari and Barrios-Garcia 2014). Some authors have interpreted the relatively high frequency of animal matter in feral swine stomachs as an indication that, at least in some areas, feral swine require a limited amount of animal matter in their diets (Balli and Barrios-Garcia 2014).

> Feral swine have been known to prey on small mammals, ground-nesting birds, their eggs and chicks, reptiles and amphibians, crustaceans, snails, insects and other arthropods. Information on the extent to which animals were scavenged or live when obtained by the feral swine is not available because the status of the animal at the time it was consumed can rarely be determined based on stomach contents.

**4. Life History**

Reproductive capacity in feral swine can vary widely depending upon where they occur, the degree to which the animals are related to domestic swine or Eurasian wild boar, and the amount of time the swine have been established in the wild (Comer and Mayer 2009). Domestic swine are generally more prolific than Eurasian wild boar, although productivity tends to decline to levels more akin to Eurasian wild boar with time in the wild. Feral swine have the potential to reproduce at high rates and those rates increase with improved habitat quality. Feral swine are generally capable of reproducing from five months to one year of age. However, in males, only older more dominant animals are likely to successfully reproduce (West at al. 2009, Comer and Mayer 2009). Feral swine can give birth year-round and females are capable of giving birth two times in a year, with multiple litters more likely in sows more than one year old and in areas with abundant year-round food supplies (Comer and Mayer 2009, West 2009). Average litter size is slightly higher for swine related to domestic pigs than for feral swine but generally range from 3-6 piglets per litter (Sweeney et al. 2003). Ditchkoff et al. (2012) reported a mean litter size for feral swine of 4.8 to 7.5 piglets, with some litters as large as 12 piglets.

A number of small to medium size predators and omnivores prey on piglets, including coyote, bobcats, turkey vultures, and larger raptors (Mayer 2009c), but only a few large predators including American alligator, black bear, mountain lion, wolves, coyotes, and feral dogs are likely to also prey on adults (Mayer 2009c, Mapston 2010). Juvenile mortality, especially during the first 3 months of life is high, but tapers during the first year (Mapston 2010). Juvenile deaths are due to suffocation by sows, starvation, parasites, disease, accidental death, hunting, and predation (Mapston 2010). When the animals reach 40 pounds or larger, there are few threats to them in the wild. Feral swine usually live 4 to 5 years under good conditions, with some living up to 8 or more years (Giuliano 2010, Mapston 2010).

Models that predict feral swine population growth rates and density assist when attempting to manage the animals. Texas A&M's model (2014) determined potential feral swine habitat by using Geographical Information Systems (GIS). Potential habitat included areas with adequate vegetation coverage and types and an adequate average rainfall (greater than or equal to 20 inches of annual rainfall, unless area was in a riparian area). Areas with high to low development were omitted. Researchers estimated that, for Texas, approximately 18 to 21% annual population growth rate, an average density of 1.33 to 2.45 hogs/ square mile, an estimate of 1.8 to 3.4 million hogs state-wide, and approximately 134 million acres (79% of the state) of habitat that is suitable to feral swine (Texas A&M 2014).

### 5. Genetics

As noted in Chapter 1, this DEIS uses the term “feral swine” refer collectively to free-ranging swine (*Sus scrofa*), belonging to the family Suidae. This term includes escaped domestic and pet swine and their descendants, Polynesian pigs, and Eurasian wild boar and their hybrids (Chapter 3.B). Physiological and behavioral characteristics and associated societal values may vary depending on the origin of the swine (McCann et al. 2014, Mayer and Hochegger 2011, Larson et al. 2007). For example, feral swine that are closely related to modern farmed domestic swine are most likely to be perceived as pests and a nuisance problem that should be removed. In contrast, swine that are more closely related to current populations of Eurasian wild boar may be perceived as a game species and valued for recreational opportunities and the characteristics of their meat. Similarly, there are communities in Hawaii and the Pacific islands that would like to see feral Polynesian pig populations maintained for cultural reasons. Modern genetic testing can differentiate among these groups of swine and inform management decisions (McCann et al. 2014, Mayer and Hochegger 2011, Scandura et al. 2011).

Genetic testing can also inform management decisions to control or eradicate feral swine by providing information on population dynamics. Genetic testing can assist in determining dispersal rates between populations and sources of reinvasion after control efforts have been implemented (Hampton et al. 2004, Spencer et al. 2005, Delgado-Acevedo et al. 2007). This information may be particularly useful when determining the scale of effort needed when agencies are working to eradicate or substantially reduce populations. Ideally, management actions would be conducted at a scale that includes the target population plus primary sources of immigrants. Similarly, knowledge of feral swine subpopulations and movements could also aid managers in responding to disease outbreaks. Caudell et al. (2013) used oral history combined with molecular analysis to understand feral swine introductions to Indiana. Combining the data allowed researchers to understand the legal and illegal introductions of feral swine into the state. Understanding the history of introduction in an area will allow for more appropriate, case-by-case management solutions.

<u>Heritage and Specialty Breeds of Pigs</u>

The Livestock Conservancy, whose mission is to ensure the future of agriculture through genetic conservation and promotion of endangered breeds of livestock and poultry, defines U.S. heritage animals as ones that are pure breeds with deep histories in the United States (Livestock Conservancy 2014). Heritage breeds were selected over time to be well adapted to the local environment and thrive under historic farming practices, mainly multi-use and open-pastured farming. Modern swine breeders may also work to cultivate varieties of pigs with specific characteristics which they believe will enhance the viability or marketability of their swine. Some swine breeds can have physical characteristics similar to European wild boar such as hairy coats which can lead to conflicts when state regulations intended to prohibit introduction and production of Eurasian wild boar, and associated risks that the swine will become free-ranging, are based on the physical characteristics of the pigs (MDNR 2011; W. C. Swartz, Jr., Keweenaw Bay Indian Community, pers. comm. 2013). Ultimately, genetic techniques may enable better and more conclusive identification of feral swine sources for purposes of regulatory enforcement (see Genetics below).

With the industrialization of farms, many animal breeds disappeared because they were not suited to a new type of farming. Current breeds are selected for characteristics that suit large scale production, such as rapid growth. Therefore, genetic diversity within swine has been drastically decreased. Some of the earlier heritage breeds of swine that were brought to the United States in the 1500s neared extinction and are now appreciated and valued for their various attributes. There have been recent movements to preserve swine diversity. Groups interested in preserving heritage swine breeds want to protect the breeds' genetic integrity, are interested in long-term conservation, encourage management strategies that are sustainable, and celebrate cultural and culinary traditions of the breeds (Livestock Conservancy 2014).

Ossabaw Island pigs are an example of a heritage variety that some people are interested in preserving. The feral swine live on Ossabaw Island, off the coast of Georgia. Spanish explorers introduced the swine onto the island in the 16$^{th}$ century as a source of food (Mayer and Brisbin 1991). The feral swine continued to occupy the island during colonial plantation development of the island and subsequent private ownership by sportsmen that hunted the animals (Brisbin and Sturek 2009). While most feral swine breed with domestic pigs, the Ossabaw Island swine, as a population, have remained relatively isolated from any significant introductions of mainland feral or domestic swine (Mayer and Brisbin 1991).

The Ossabaw Island swine have a heavy coat and long snout. They are smaller than most feral swine, weighing less than 200 pounds. Those that want to preserve the breed believe it is the closest genetic representative of historic stocks of pigs brought over by the Spanish, the population provides a great example of a long-term natural population, and the breed is biologically unique because it has been shaped by natural selection in a very challenging environment known for heat, humidity, a diet with high salt content, and food scarcity. However, as with swine in other ecosystems the Ossabaw swine adversely impact native species and habitats and the swine have been documented disturbing nests and eating eggs of federally-listed endangered loggerhead sea turtles and snowy plover. Because of the impacts of the swine on native vegetation and animal species, the Georgia Department of Natural Resources works to reduce and closely manage the feral swine population on the Island (Georgia Department of Natural Resources 2000). The only other remaining individuals of this breed are in existing breeding populations kept off-island by farmers for their value as heritage pork and in limited populations in zoos and parks.

# B. Agriculture

## 1. Impacts of Feral Swine on Agriculture

### *a. Crop Impacts*

Hogs will feed on almost any agricultural crop they find, especially crops adjacent to riparian areas. They eat seeds, seedlings, mature crops, hay, turf, and gardens. Feral swine damage pasture and agricultural crops by consumption, rooting, digging, and trampling (Seward et al. 2004). Rooting can affect the plant composition of a pasture by promoting the growth of undesirable plants where hogs have destroyed desirable forage grasses. Once pastures are degraded in this way, landowners must spend considerable money and time restoring them to pre-swine conditions (Whitehouse 1999, Mapston 2004).

Feral swine will travel long distances to consume attractive foods. One study reported that feral swine traveled 6 miles to forage on sorghum (Mungall 2001). In a survey of extension agents in Texas, Rollins (1993) found the most common complaint was damage to crops, including hay, small grains, corn, and peanuts. Crops such as vegetables, watermelons, soybeans, cotton, tree fruits, and conifer seedlings were also affected by wild pigs. The presence of feral swine in agricultural areas is likely to lead to requests for assistance to manage and prevent damage to agricultural crops. Feral swine also cause damage to pastures, land used for hay, and sod farms by their rooting and wallowing activities (Beach 1993).

Feeding activities of feral swine on agricultural crops can lead to increased erosion due to the removal of vegetation, leaving bare soil. Since feral swine often travel in family groups, damage from rooting and wallowing can be extensive and encompass several acres. Use of agricultural crops as a forage resource by feral swine may make up 71% of the plant material consumed (Mayer and Brisbin 2009). A single group of feral swine can destroy a 10-acre cornfield in less than a week (Gates 2012).

Although it is certainly not realistic to suggest that the entirety of the $223 billion in crop production (2012) in the United States is at risk of being destroyed, it is worth noting that between 60 and 80% of row crop production takes place in States that have a confirmed feral swine population (NASS 2014). In states where feral swine have been established for several years, data documenting feral swine damage to agriculture exists. In one study area in Texas, 48 cooperators estimated damages and expenditures to manage feral swine totaling $2,228,076 on 230,017 acres they owned or controlled. In Georgia, respondents to a questionnaire developed by the Georgia Feral Hog Working Group reported an average loss to crops and/or crop related damage due to feral swine during 2011 at $12,646 per respondent (response rate of 39.25%; Mengak 2012). In 2011, it was estimated that feral swine caused in excess of $57 million dollars in damages to agriculture and an additional $24 million in damage to non-crop values in Georgia (Mengak 2012). In 29 counties in northern Florida in 2009, feral swine damaged and estimated $314,739 of corn, $327,943 of cotton, $1,151,178 of peanuts, and $30,815 of soybeans (Ober et al. 2011). In California, agricultural commissioners reported feral swine caused $ 1,731,920 in damages (Seward et al. 2004).

No detailed national studies are available quantifying potential damage to row crops by feral swine. One commonly cited national estimate of annual damage to row crops uses an estimate of $200 in agricultural crop damage per feral swine per year and a U.S. feral swine population estimate of 4 million animals to generate a nationwide estimate of $800 million in damages to the U.S. agricultural sector annually, and as much as $1.5 billion per year in total damage and control costs (Pimentel 2005). This estimate is likely very conservative because it uses a conservative estimate of the national feral swine population and it does not consider livestock predation, disease transmission, or environmental degradation.

### *b. Livestock Impacts*

Predation

Feral swine sometimes prey on livestock, including lambs, kids (goats), newborn cattle, poultry, and exotic game. Predation on young livestock animals usually occurs on calving or lambing grounds where feral swine may be attracted by afterbirth (Wade and Bowns 1985, Gallagher undated). Though predation is usually concentrated on young animals, livestock giving birth are sometimes killed and consumed (Wade and Bowns 1985). In addition to directly preying on livestock, when feral swine damage fencing they leave livestock vulnerable to predators and offer opportunities for livestock to escape (West et al. 2009).

Wild pig predation on livestock can be difficult to verify because the entire carcass is usually consumed, leaving little evidence. In addition, pigs will scavenge carcasses killed by other animals. If the whole carcass is not consumed, however, feral swine usually follow a characteristic feeding pattern that can be used to identify the source of the damage (Pavlov and Hone 1982). They typically kill their prey by biting and crushing the skull or neck (Frederick 1998). The carcass typically will be skinned and the rumen or stomach contents consumed (Wade and Bowns 1985).

Feral swine cause serious economic loss to the livestock industry, although exact numbers and values are uncertain. This is due, in part, to the misidentification of the cause of predations. For example, signs of coyote (*Canis latrans*) and feral swine predation appear very similar; therefore cases reported as coyote predation may actually be feral swine (Seward et al. 2004).

In 1990, 1,243 sheep and goats were documented as being lost to feral swine in Texas, with an estimated value of $63,000 (Rollins 1993). Barrett and Birmingham (1994) reported 1,473 sheep, goats, and exotic game animals were killed by feral swine in Texas and California in 1991. Texas produces 1.1 million goats annually; about 90% of the goats raised in the United States (Scrivner et al. 1985, and Pearson 1986) reported that predators killed 18% of adults and 34% of kids. The number of goats lost to feral swine predation in unknown, but is likely substantial (> $1 million; Seward et al. 2004).

Disease Threat to Livestock

The cattle and swine industries are the industries at greatest of potential impact by feral swine. The cattle industry's $49.2 billion in production (2012) could be dramatically impacted by diseases transmitted by feral swine, as could the $15.8 billion swine industry. While a disease incident is unlikely to affect either industry entirely, trade with other countries could very likely be impacted. U.S. pork exports in 2012 totaled over $5.1 billion, while beef exports were over $4.7 billion (USITC 2014).

Pork production in the United States accounts for about 10% of the total world's supply. The United States is one of the world's largest producers of pork and is the second largest exporter of pork. The retail value of pork sold to consumers exceeds $30 billion annually (USDA 2008). Disease transmission by feral swine is likely to occur where domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas. Transitional domestic swine raised in fenced enclosures are at greatest risk of disease transmission from feral swine.

Feral swine are capable of carrying numerous parasites and diseases that potentially threaten the health of livestock (Forrester 1991, Williams and Barker 2001, Sweeney et al. 2003). Feral swine can harbor at least 30 significant viral and bacteriological diseases (Williams and Barker 2001; Table 3-3) and feral swine in Florida have been documented to have as many as 45 different parasites and infectious diseases (Forester 1991).

These include 37 parasites (12 protozoans, 17 nematodes, 1 acanthocephalan, 1 sucking louse, 4 ticks, and 2 mites), 7 bacteria, and 1 virus. The diseases of most concern to the livestock industry include pseudorabies, swine brucellosis, bovine tuberculosis, leptospirosis, and vesicular stomatitis (Nettle et al. 1989, Davidson and Nettles 1997, Williams and Barker 2001, Davidson 2006). These and the possibility of an exotic disease outbreak, such as foot and mouth disease, a contagious viral disease of ungulates (e.g., pigs, sheep, cattle, goats, and deer) (Pech and McIlroy 1990), or classical swine fever (a contagious viral disease of wild and domestic swine), could have serious repercussions for the United States livestock industries (Hone et al. 1992). On the other hand, feral swine may serve as a surveillance tool for the early detection of exotic diseases (Mason and Fleming 1999; Witmer et al. 2003).

Feral swine in the United States have tested positive for several of these diseases listed above. Corn et al. (1986) found that out of a larger sample, 124 feral swine tested positive for diseases in Texas; pseudorabies (36%), brucellosis (3%), and leptospirosis (33%). A study in Oklahoma that collected samples from 120 feral swine found they tested positive for antibodies of porcine parvovirus (17%), leptospirosis (44%), IAV-S (11%), and porcine reproductive and respiratory syndrome virus (2%; Saliki et al. 1998). Since 2006, NWRC has implemented disease monitoring programs for swine brucellosis, pseudorabies and classical swine fever across the nation. NWRC periodically also monitors for other diseases in feral swine in partnerships with state and federal agencies and research institutions. A summary of information from this survey is provided in Table 3-4.

**Table 3-3.** A partial list of viral and bacterial diseases to which feral swine are susceptible (Williams and Barker 2001).

| Viral Diseases | Bacterial Diseases |
|---|---|
| Bovine herpesvirus | Anthrax |
| Classic swine fever (hog cholera) | Brucellosis suis |
| Coronaviral infection | *Erysipelothrix* infections |
| Encephalomyocarditis | *Helicobacter* spp. |
| Foot-and-mouth disease | Leptiosporosis |
| Influenza A | Bovine tuberculosis |
| Louping-ill virus | Pasteurellosis |
| Malignant catarrhal fever | Plague |
| Menangle virus | Salmonellosis |
| Papillomavirus infections | Yersiniosis |
| Parainfluenza Virus | |
| Pestivirus infections | |
| Pseudorabies (Aujeszky’s disease) | |
| Rabbit hemorrhagic disease | |
| Rinderpest | |
| San Miguel sea lion virus | |
| Swinepox virus | |
| Swine vesicular disease | |
| Vesicular swine virus | |
| Vesicular stomatitis | |

Although the source of livestock disease outbreaks can be difficult to identify, a risk of transmission and the spreading of diseases to domestic swine and other livestock exists wherever feral swine and domestic livestock interact. A disease outbreak not only has negative economic implications to the individual livestock producer but also can cause economic losses that can negatively affect the statewide swine industry.

**Table 3-4.** Nationwide disease surveillance results for select pathogens that pose a risk to humans, domestic animals and livestock. All results reflect antibody prevalence. (Bevins et al. 2014).

| Disease | Taxonomic Association | Years Conducted | Sero-prevalence | 95% Confidence Interval | Description |
|---|---|---|---|---|---|
| Brucellosis | *Brucella* spp. | 2006-2012 | 4.3% | 4.0-4.6% | Multiple *Brucella* species and biovars, some of which can be transmitted to multiple species, including humans, in which they can cause serious disease. |
| Influenza A | Multiple strains of Influenza A and C | 2010-2012 | 10.8% | 9.9-11.8% | Multiple strains of influenza can circulate in swine including the 2009 outbreak of a novel H1N1 strain that eventually spread to people worldwide. |
| Pseudorabies (as Aujeszky's disease) | Suid herpesvirus I | 2007-2012 | 15.5% | 14.9-16.1% | Endemic swine disease that can be transmitted to other wild and domestic animals including cattle, sheep and dogs. |
| Trichinella | Nematoda | 2009-2012 | 2.0% | 1.5-2.6% | Parasitic roundworm with a wide range of potential hosts, including humans, who can be exposed through ingestions of undercooked swine meat. |
| Hepatitis E | Hepatitis E virus genotypes 3 and 4. | 2010-2012 | 4.4% | 3.7-5.2% | Can cause brief acute illness in infected people, with feral swine potentially acting as a viral reservoir and with transmission to humans occurring through the consumption of swine. |

*Brucellosis:* Swine brucellosis is caused by *Brucella suis*, a bacteria that is similar to the one that causes brucellosis is cattle. Cattle that are in close contact with swine harboring the disease may become infected (USDA 2005a). Swine infected with the disease can develop clinical signs or appear healthy; making laboratory tests an important diagnostic tool. Infection can move through a herd quickly. Swine brucellosis is a zoonotic bacterial infection and is transmitted through oral and venereal routes (Thorne 2001). Boars can shed bacteria in their semen, and both sexes may experience short-term or permanent sterility. Infected sows may abort or give birth to weak piglets. Infection can also cause lameness.

From March 2009 through December 2010, the percentage of samples testing positive for brucellosis ranged from 0.7 to 14.4% in a study examining blood samples of feral swine from 13 states, including New York (Pederson et al. 2012). Seropositive feral swine were often clustered in one area within a state (Pederson et al. 2012). Feral swine are a reservoir for the *B. suis* disease, and have the potential of transmitting it back to domestic herds (Pederson et al. 2012).

*Pseudorabies Virus (PRV):* Pseudorabies is a viral disease most prevalent in swine, often causing newborn piglets to die. Older pigs can survive infection, becoming carriers of the pseudorabies virus for life. It is an alpha herpes virus and transmission usually occurs by oral or venereal contact (Wyckoff et al. 2009). Other animals infected by swine die from pseudorabies, which is also known as Aujeszky's disease and "*mad itch*." Infected cattle and sheep can first show signs of pseudorabies by scratching and biting themselves. In dogs and cats, pseudorabies can cause sudden death. The virus does not infect humans. In 2004, Commercial swine in the United States recently achieved pseudorabies-free status after a 17-year effort and the expenditure of approximately $200 to $250 million dollars (Hutton et al. 2006).

*Avian Includena A in Swine (IAV-S):* Swine Influenza Virus is a viral infection in swine that is common throughout the world. It causes a respiratory illness in pigs. Symptoms include acute respiratory disease characterized by fever, inactivity, decreased food intake, respiratory disease, coughing, sneezing, conjunctivitis, and nasal discharge (Vincent et al. 2008). IAV-S is a herd disease with a high rate of infection within the herd but generally low mortality (Vincent et al. 2008). The emergence of new subtypes of SIVs (hu-H1, H3N2, H4N6, H2N3, and hu-H3) in North American pigs has implications for pigs and people who care for them. Newly emerging viruses are capable of epidemics at the herd level since they are antigenically distinct from previously circulating and/or currently used commercial vaccine strains, are virulent in the pig, and can infect and transmit from pig to pig (Vincent et al. 2008).

*Leptospirosis:* Leptospirosis is a worldwide zoonotic disease of domestic animals and wildlife. It is caused by a spirochete bacteria classified under the *Leptospira*. Infections may be asymptomatic or cause various signs, including fever, jaundice, bloody urine, renal failure, infertility, abortion, and death (Aiello and Moses 2011). Abortions are the most common manifestation in pigs. After acute infection, leptospires frequently localizes in the kidneys or reproductive organs and are shed in the urine, sometimes in large numbers for months or years. Because the organisms survive in surface waters, such as swamps, streams, and rivers, for extended periods, the disease is often waterborne. The organism survives well in mud and moist, alkaline soil, such as riverbanks. Floods frequently result in an increase of disease outbreaks (Merck Veterinary Manual 2011). A number of wildlife species have been implicated as reservoirs for the bacteria including raccoons, opossums, squirrels and feral hogs (Chatfield et al. 2013).

*Porcine Reproductive and Respiratory Syndrome Virus (PR RSV):* PRRSV was first reported in the United States in 1987 (Merck Veterinary Manual 2011). The disease causes reproductive failure during late-term gestation in sows and respiratory disease in pigs of all ages. In 2006, a new, highly pathogenic PRRS emerged, characterized by high fever (41°C–42°C), skin discoloration/reddening, high incidence of illness (50%–100%), and high proportion of deaths (20%–100%) in pigs of all ages.

*Anthrax:* Anthrax is a soil-borne disease that occurs in some states, usually where the daily minimum temperature is at least 60 degrees F, where wet periods are followed by long, dry periods, and where soils are alkaline or neutral. All mammals, especially ruminants, are susceptible to anthrax. Feral swine may come into contact with the bacteria while feeding or by interacting with infected animals.

*Foreign Animal Diseases:* Feral swine can serve as a reservoir and amplifier for many diseases, making it difficult or impossible to eradicate disease in livestock in areas with feral pigs (Hone et al. 1992, Corn et al. 2005, Hutton et al. 2006, Wycoff et al. 2009). Feral swine could potentially play a role in spreading and perpetuating exotic diseases in the future. For example, foot-and-mouth disease, which was eradicated from the U.S. in 1929, would be essentially impossible to eradicate again if it reemerges in areas with feral swine (West et al. 2009). If foot-and-mouth disease were to reemerge in the U.S. commercial swine herd, it could result in a reduction of $14 to 21 billion in U.S. farm income (Paarlberg et al. 2002).

Foot-and-mouth-disease (FMD) is a foreign animal disease (FAD) of great concern because it is highly contagious, spreads rapidly, can cause serious economic losses, and can constrain international trade in livestock products. It is a viral disease of ungulates (mainly cloven-hoofed ruminants, including swine) and some rodents. Symptoms include fever and blister-like lesions on the tongue, teats, lips, inside of the mouth, and between the hooves. Many infected animals recover, but some may be permanently debilitated. The virus can be spread by contact with infected animals and with contaminated feed, water, or equipment (Mapston 2004).

Classical Swine Fever (CSF) is a highly contagious foreign viral disease that affects swine. Once called hog cholera, CSF has been eradicated from many developed nations, including the United States. Depending on the strain of the virus, the virus can either be very virulent and cause high mortality in swine herds, or it can be mild with the only symptoms being poor performance and failure to thrive (CFSPH 2009).

Trade and Market

Therefore there is concern relative to the role feral swine could pose to the pork industry as a reservoir for disease. The introduction of a FAD to the commercial herd would have serious implications to agricultural industries. Although the U.S. has not experienced a FMD outbreak since the 1920's, several other developed countries (e.g., Taiwan, the U.K., the Netherlands, Ireland, France, and Italy) have experienced outbreaks in recent decades, leading to concerns about FMD in the U.S. (Paarlberg et al. 2003). Outbreaks of FMD in domestic swine in the U.K., Ireland, France, and the Netherlands necessitated the destruction of 6 million head of livestock, which had an estimated value of $11 - $12 billion (FAO 2009). If FMD or other foreign animal disease were to occur in the feral swine population, it would substantially increase the cost and complexity of management and eventual eradication of the disease.

Cozzens et al. (2010) modeled the potential spread of FMD from feral swine to livestock and within livestock in Missouri using the North American Animal Disease Spread Model (NAADSM) and predicted an expected livestock loss of 18,658 animals until the disease was eliminated. This implies a direct economic loss of $7.5 million resulting from a disease outbreak lasting 45 days. Indirect losses were estimated at $4.4 million, based on a decrease in producer revenue of $7.5 million. Thus, the expected total economic impact of feral swine FMD outbreak was nearly $12 million from a 45-day disease outbreak.

PRV is by no means the only disease that could create a significant impact to the swine and other livestock industries, and effects of other diseases potentially could be even more significant. Swine brucellosis, for example, poses a risk not only to swine and other livestock, but can also infect humans who come into contact with infected pigs. Swine-carried tuberculosis is a similarly zoonotic hazard.

Bovine tuberculosis (*Mycobacterium bovis*) has been a recurring concern for the Hawaiian island of Molokai (USDA 2006). In 1985, the entire population of cattle on the island was depopulated in an effort to eradicate the disease. However, in 1997, a cow that originated from Molokai was determined to be infected with *M. bovis* with subsequent depopulation of the infected herd. No additional infected animals were found. A wildlife survey was conducted which found feral pigs infected with *M. bovis*. The area the feral pigs were sampled was located in the same area the infected cow resided. DNA fingerprinting of the *M. bovis* strain found in infected cow showed a similar profile to the *M. bovis* strain found in the feral swine.

In 2006, APHIS conducted a risk assessment to study the transmission of bovine tuberculosis from feral swine to cattle on the Hawaiian island of Molokai (USDA 2006). At the time of the risk assessment, a testing protocol was in place to reduce the risk of infected animals mixing with animals from portions of the island and state where the disease does not occur. The testing program included annual complete herd testing of cattle and goats as well as testing for movement other than for slaughter. Costs associated with one round of testing for bovine tuberculosis on Molokai, Hawaii were $17,499 with two rounds of testing needed prior to export. Costs of the testing program are summarized in Table 3-7.

**Table 3-7**. Costs associated with one round of testing for bovine tuberculosis on Molokai, Hawaii, 2006 (APHIS Risk Assessment - Transmission of Bovine Tuberculosis (*Mycobacterium bovis*) from Feral Swine to Cattle on the Island of Molokai 2006).

| Ranches | Labor | Airfare | State Admin Expenses | Livestock Inspector Mileage Expenses | Eartag Expenses | Tuber-culin Expenses | Total |
|---|---|---|---|---|---|---|---|
| Puu-O-Hoku Ranch | $4,111 | $900 | $47 | $60 | $150 | $620 | $5,888 |
| Kapualei & Kaluaaha Ranches | $2,489 | $450 | $47 | $40 | $40 | $215 | $3,281 |
| Pedro | $4,186 | $900 | $47 | $60 | $40 | $287 | $5,520 |
| Kililikane | $2,231 | $450 | $47 | $40 | $7 | $34 | $2,809 |
| Total | $13,017 | $2,700 | $47 | $200 | $237 | $1,156 | $17,499 |

### *c. Other Agriculture Impacts*

Feral swine commonly cause significant damage to agriculture infrastructure. In addition to directly damaging crops, feral swine can damage fences, irrigation ditches, roads, dikes, and other structures. Rooting and wallowing in agricultural fields creates holes that, if unnoticed, can damage farming equipment and pose potential hazards to equipment operators (Nunley 1999). In Texas, 72% of surveyed extension agents reported additional damage to ranch facilities (e.g., fences, water supply, irrigation ditches, and guzzlers) (Seward et al. 2004). Feral swine wallowing can severely muddy ponds and streams and cause algae blooms, oxygen depletion, bank erosion, and soured water (Mapston 2004).

Because of their size and strength, feral swine can damage even robust fences, thus compromising the fence’s ability to contain livestock and exclude predators. Fence damage, including torn netting, holes, and weakened wires and posts, can allow livestock to wander, give access to predators, and result in costly repairs (Mapston

2004). Although no one has estimated the economic impact of this damage, it has the potential to be significant in terms of fence repair costs and escaped livestock (Beach 1993).

Feral swine consume supplemental food and damage feeders and food plots intended for livestock and wildlife. When feral swine frequent these sites other animals often avoid them (Mapston 2004). Additionally, feral swine compete with livestock by rooting up and eating vegetation intended for livestock feed (Mapston 2004).

## 2. Agriculture Resources Which May Be Impacted by Feral Swine Damage Management

### *a. Damage and Disease Risks*

Section B.1 describes the economic impact of feral swine damage to agriculture. It is likely that many of the losses described would be alleviated or significantly lessened in areas targeted for FSDM. In Texas alone, reports of feral swine damage to agriculture were estimated at $51.8 million annually (Adams et al. 2005). Pimental et al. (2005) estimated the annual cost associated with feral swine damage at $800 million, but suggested this estimate is conservative because damages associated with diseases are not easily translated into dollar values.

USDA-APHIS established successful national eradication programs for swine brucellosis and pseudorabies, and have ongoing bovine tuberculosis with a goal of elimination of these diseases from all commercial livestock herds in the United States (Witmer et al. 2003). Unfortunately, one of the most serious setbacks to achieving this goal is the widespread and growing occurrence of feral swine populations across the country. Lack of feral swine control could significantly hinder the accomplishment made by these programs. Elimination of feral swine from some areas may also reduce management costs for transitional and back-yard producers by eliminating the need for additional fencing or other structures to prevent contact between feral and domestic swine.

### *b. Hunting Preserves and Associated Swine Production*

Escapees from poorly monitored and maintained enclosed hunting preserves have contributed to the range and magnitude of feral swine populations (Bratton 1975, Bevins et al. 2014). Nonetheless, feral swine hunting preserves can be a profitable business and some states do allow hunting preserves and/or the breeding and holding of feral swine for use in hunting preserves (Appendix D Table 3). It is possible that some of these states could revise the regulations pertaining to feral swine hunting preserves in response to a national feral swine population damage management effort. For example, Michigan declared *Sus scrofa* to be an invasive species in the state and possession of this species is now prohibited and it may not be used in hunting and breeding facilities (MDNR 2013). Producers were given a set time interval to eliminate their captive wild boar herds. Alternatively, some states may choose to increase monitoring, reporting, or fencing requirements.

#### *c. Use of Pastures for Swine Production*

There is increasing public interest in animal production systems which do not include close confinement of animals and in free range or pasture raised livestock including swine (Penn State Extension 2011, Clancy 2006). Risk of disease transmission between feral and domestic swine is greatest for pasture raised swine in areas with feral swine populations. Fencing can also be effective in reducing risks of disease transmission. However, construction and maintenance of fencing which can prevent contact between feral and domestic swine, entrance of feral swine and/or exit of domestic swine can be labor intensive and expensive. Removal or reduction of feral swine populations in these areas can eliminate or reduce risks depending on the level of removal achieved.

As with hunting preserves, escapees from farms which raise domestic swine in pastures have contributed to the feral swine population. A national feral swine program and increased awareness and interest in reducing or eliminating feral swine populations may have indirect impacts on domestic swine production in pastures. States, Territories, and Tribes working to eradicate swine or prevent feral swine from becoming established may consider mechanisms to prevent escape of pigs from pastures including increasing fencing or monitoring and reporting requirements which would likely result in increased costs to producers. In areas where feral swine eradication is not possible, State, Territorial, or Tribal agencies could increase fencing requirements (e.g., require double fencing) to prevent contact and potential disease transmission between feral and domestic swine.

## C. **Natural Resources**

### 1. Natural Resources Affected by Feral Swine

Soil quality describes the capacity of soil to provide ecosystem services. Preserved soil quality allows for sustained plant and animal productivity, maintained or enhanced water and air quality, and improved plant and animal health (Herrick 2000). Soil quality is degraded by erosion, compaction, loss of soil structure, loss of nutrient content, and changes to soil salinity (Cook 1990). Although some level of soil disturbance is natural, soils subjected to severe or low-level chronic disturbance may not function as well in terms of soil stability, production, resistance to erosion and other ecosystem services.

### *a. Soils, Water, and Fungi*

Soil creation and soil loss

Soils are formed from the mechanical and chemical weathering of rocks and other parent material, or from loose deposits that have been transported by the process of erosion. Soil erosion is a natural process within ecosystems that removes and redistributes soil. A soil system is in equilibrium when soil erosion is in balance with the formation of new soil (Wall et al. 2012). In general, fine sand and silt components of a soil, along with the particulate organic matter, are more easily eroded and transported by erosion.

Physical Characteristics of Soils

Soil is categorized based on a number of factors including how well water filters through it (permeability); how much water it holds after excess water has drained (water-holding capacity); the size of the particles (soil texture); its ability to clump and hold together (soil structure); and its chemical properties (e.g., pH, salinity, etc.). The USDA Natural Resources Conservation Service has categorized soils into 12 soil orders and 64 suborders (Soil Survey Staff 1999). Based on their different characteristics, soil orders and suborders have varying capacities to support ecosystem services (i.e. retain water, filter water impurities, cycle nutrients, anchor plant roots, and absorb air pollutants). As a result, different soil types are impacted differently, and to varying degrees, by disturbance.

Soil is organized into visibly, chemically, and physically distinct layers, called horizons. There are five soil horizons: O, A, E, B, and C. Not all of these layers are present in every location, and horizon layering (called a soil profile) can vary depending on the amount of vegetation and water in the environment. The O horizon consists of at least 20 percent organic matter by mass. The low oxygen levels that occur within this horizon slow the decomposition process and allow organic material to accumulate, and plant matter, like leaves, is generally still recognizable. The A horizon is composed of mineral soil, and is commonly referred to as topsoil. Compared to other mineral horizons, it is rich in organic matter. Natural events, such as flooding and wind storms, can bury or remove an A horizon so that it is no longer found at the surface. The E horizon has lower clay content, making it lighter in texture than either the A or B horizons. The B horizon is also composed of mineral soil, but it contains a larger portion of clay, salts, and iron. As a result, it tends to be denser than other horizons. Processes such as accelerated erosion can sometimes strip away overlying horizons and leave a B horizon at the surface. The C horizon consists of less refined materials, such as lake sediments that have little to no alterations. In general, additions and losses of soil are minimal within this horizon.

Soils are an important component of the global carbon cycle, as they hold and release carbon. Over two-thirds of the carbon of terrestrial ecosystems is stored within the soil (Powlson et al. 2011), and there is growing evidence of critical feedbacks between climate change and soil processes (Wall et al. 2012). The amount of carbon that is released from the soil as carbon dioxide, a greenhouse gas that is considered a major contributor to global climate change (Solomon et al. 2009), is a function of soil organic matter, microbial activity, temperature and moisture, and nutrient concentrations. Changes to any one of these parameters can increase or decrease carbon dioxide emissions from the soil (Wall et al. 2012). For example, as soil temperature rises, the amount of carbon dioxide released from the soil increases (Risch et al. 2010). Large animals, such as swine and cattle, that significantly disturb the soil by digging or trampling can directly affect these parameters through physical disturbance, and can increase the amount of carbon released from the soil as carbon dioxide (Risch et al. 2010).

Feral swine turn over the ground surface when digging (rooting) for plants, fungi or animal material to eat. Depending upon soil conditions and the availability of underground food sources, feral swine rooting may range from only an inch or so to approximately a yard in depth. The size of uprooted areas can range from relatively small patches to acres in size. In one example recorded in Savannah Preserve State Park in Florida, feral swine uprooted a 2.2 acre (9,027 $m^2$) continuous patch to a depth of approximately 16 inches (42 cm; Engeman et al. 2007a).

Feral swine also impact soils through trampling and the use of sites for wallowing (Vtorov 1993, Karlen et al. 1997). Feral swine lack sweat glands to aid in cooling and use mud wallows to lower body temperature and for protection against insects. Wallows are shallow depressions containing mud or muddy water. Some wallow sites can be used repeatedly over a period of years while other are temporary, and may dry up after only a season of use (Mayer 2009c). The area adjacent to wallows that is used repeatedly is commonly denuded of vegetation with compacted soils. Frequent use can lead to elimination of vegetation and soil disturbance and compaction in the area immediately adjacent to the wallow. Wallows can be located anywhere but are commonly located in or adjacent to riparian or bottomland habitats (Mayer 2009*c*, Chavarria et al. 2007).

Data on the impacts of feral swine rooting on soil structure, chemistry, bulk density and nutrient cycling are limited and provide mixed conclusions (Barrios-Garcia and Ballari 2012). Singer et al. (1984) documented reductions in depth of upper soil horizons, particularly the O and A layers (Singer et al. 1984) and reduced bulk density of soils in rooted areas of Great Smoky Mountain National Park. Rooted areas also had lower levels of leaf litter. Reductions in soil density can increase the rate of nutrient leaching in soils, and reduced levels of calcium, phosphorous, zinc, copper and magnesium were observed in leaf litter and soils in rooted areas (Singer et al. 1984, Mohr et al. 2005). Inorganic nitrogen concentrations were lower in the litter of stands with feral swine rooting, but nitrate and ammonium levels increased which may indicate that at least some of the soil nitrogen was converted to other forms instead of leeching out of the system. Sieman et al. (2009) also measured increased nitrogen mineralization rates.

In some situations impacts of feral swine rooting can be beneficial or rooting may have little impact on the system. Rooting can be similar to tilling in crops which increases nutrient cycling and decomposition rates, but also increases nitrogen loss through leaching or direct erosion of soil (Barrios-Garcia and Ballari 2012, Wirthner et al. 2012). Wirthner et al. (2012) detected increases in soil carbon, nitrogen and microbial biomass carbon in soils of Swiss hardwood forests supporting the hypothesis that rooting enhanced decomposition and faster nutrient turnover rates in rooted soils. However, in contrast to Singer et al. (1984) plant available nitrogen was lower in rooted plots than unrooted plots. Wirthner et al. (2012) hypothesized that differences in plant available nitrogen between their study and that of Singer et al (1984) may have been attributable to differences in plant uptake (i.e., use for growth), use by the increased microbes in soil, or loss through leaching or erosion. Tierney and Cushman (2006) did not detect any differences in ammonium and nitrate in soils within and without feral swine exclosures over time, nor did they detect changes in organic matter content or particle size. Similarly, a study in the Netherlands failed to find any differences in soil pH, organic matter, or nitrogen (Campbell and Long 2009a) between rooted and unrooted portions of Scots pine (*Pinus sylvestris*) plantations. Feces from feral swine can, in theory, provide some soil enrichment, although the ultimate value of this benefit in the context of other adverse environmental impacts has been questioned (Stankus 2014).

The limited number of studies assessing impacts of feral swine on soil structure and chemistry and the general lack of replication in methods or among habitat types make it difficult to make determinations regarding the variation in feral swine impacts on soils. Ultimately, the impact of rooting on soils is likely to vary among ecosystems environmental conditions with variations likely occurring between types of ecosystems (e.g., grassland vs woodland) and within ecosystem types. Frequency and intensity of disturbance may also be factors in determining feral swine impacts.

Water and Aquatic Organisms

Water quality and availability is closely related to soil quality. When a soil is well managed, its porosity (or the space between soil particles) allows it to be an efficient receiver of rainwater. Water that infiltrates the soil, in the absence of excessive nutrient or contaminant loads, is generally purified before entering groundwater sources or returning to surface water bodies (Karlen et al. 1997). However, if the soil is improperly managed or disturbed and the porosity insufficient, water may run off the surface, carrying potential pollutants and soil particles with it. This process of removal contributes to soil erosion. When this eroded soil enters surface waters as sediment, it negatively impacts water quality. This impact is magnified in riparian and floodplain habitats, which are especially sensitive to changes in water quality (Doupé et al. 2010). Smaller particles such as clay stay in suspension for very long periods, contributing significantly to water turbidity (Cook 1990). By volume, sediment is the largest cause of impairment of rivers and streams across the United States (Cunningham et al. 2001) and the second largest overall (EPA 2013a).

Rooting loosens soil, and substantially reduces litter layer cover and vegetation which would otherwise help combat erosion (Lacki and Lancia 1983, Vtorov 1993, Seward et al. 2004). Soil damage may adversely impact the quality of both surface and subsurface water resources and soil-borne pathogens and parasites may become more prevalent (Vtorov 1993, Mayer 2009*a*). Singer et al. (1984) did not document any changes in soil sediment yields in areas altered by pig rooting. However, water sampling indicated levels of nitrate and potassium in watersheds disturbed by feral swine rooting. In a Hawaiian watershed, total suspended solids in runoff from streams during storm events were consistently greater in areas with feral swine (Dunkell et al. 2011). Doupé et al. (2010) noted that although feral swine foraging in wetlands and temporary lagoons increased problems with water turbidity and low dissolved oxygen, the adverse impacts associated with pigs were not as great as those associated with other factors such as flooding, ambient temperature, and amount of rainfall.

Kaller et al. (2007) observed increases in waterborne bacteria, including increases over the levels considered acceptable under state and federal water guidelines, in areas damaged by feral swine in Louisiana. Although there were many potential sources of *Escherichia coli* (fecal coliform bacteria) in water, polymerase chain reaction (PCR)-based testing identified a more than 95% similarity between coliform bacteria in the contaminated water and samples from hogs harvested within the treated area. The bacteria also differed from 900 other bacteria samples from a range of domestic animals and wildlife.

<u>Soil Biota including Fungi</u>

Soil biota are the various organisms that live on or near the surface of the soil (Barrios 2007). Most soil invertebrates are found within the upper 10 centimeters of the soil. Soil disturbance and foraging by feral swine can alter the cycling of nutrients in the soil, decrease rates of nitrogen retention, and decrease soil microbe populations (Seward et al 2004, Vtorov 1993, Mack and D'Antonio 1998). In most ecosystems, soil biota can have direct and indirect impacts on land productivity by helping to regulate a number of key ecosystem services, including plant production, nutrient and carbon cycling, maintenance of soil structure, and water regulation

(Barrios 2007, Wall et al. 2012). Millions of bacteria and fungi are often found in fertile surface soils (Tiedje et al. 2001). Soil organisms include various types of bacteria, fungi, protozoa, nematodes, and invertebrates such as earthworms and ants. Each type of soil organism is specialized in its contribution and support of various ecosystem services. To varying degrees, soil biota are sensitive to physical and chemical changes of the soil.

Soil invertebrates break dead organic matter, such as leaf litter, into smaller pieces and facilitate decomposition by soil bacteria and fungi, which further process nutrients for plant growth. The earthworm, common throughout North America, is often referred to as an ecosystem engineer because of its wide ranging impacts on the soil ecosystem (Cole et al. 2006). In addition to decomposition, the presence of earthworms can reduce surface runoff due to the pores and tunnels they create in the soil by burrowing. The numbers, species diversity, and distribution of soil invertebrates depend on soil fertility, moisture, density, and pollution level (Vtorov 1993).

Biological soil crusts are communities of soil organisms living at the surface of desert soils that play many important ecological roles within semiarid and arid landscapes. They consist of green algae and significant fungal, microbial, and invertebrate populations, which facilitate increased soil stability, help prevent soil erosion, and “unlock” vital nutrients (such as phosphorus), releasing them back into the soil (Belnap and Lange 2001). Biological soil crusts also help reduce runoff, which increases water infiltration and the amount of water stored for plant use.

Soil bacteria and fungi offer powerful metabolic machinery for performing essential ecosystem processes and are important for the decomposition of organic matter. They also catalyze important transformations in the carbon, nitrogen, and phosphorus cycles. Mycorrhizae are fungi whose hyphae grow into or around the cells in plant roots and help plants absorb water and nutrients from the soil. Mycorrhizae are found in most soils on earth and form symbiotic relationships with over 80% of plant species (Smith and Read 2008) and nearly every food crop (Wall et al. 2012). The positive direct impacts of mycorrhizae on crop yields have been well documented (Smith and Read 1997, Giller and Wilson 2001). In addition, these soil fungi often increase the disease and drought resistance of plants (Heijden and Sanders 2002). Not all impacts of fungi are beneficial and some forms are known to cause disease in plants such as the fungus *Phytophthora cinnamomi* which causes root rot in native vegetation in Hawaii and *Phytophthora ramorum* which causes sudden oak death (Kliejunas and Ko 1976, www.suddenoakdeath.org). In addition to their ecological function in decomposition and plant growth, fungal fruiting bodies are consumed by a wide variety of species including people (Boa 2004, Alexander et al. 2002, Dubay et al. 2008).

Studies on the impact of feral swine rooting on microbial activity or decomposition rates are extremely limited (Barrios-Garcia and Ballari 2012). A study in Germany detected decreases in soil microbial activity in response to simulated feral swine disturbance. However a study in Switzerland found a significant increase in soil respiration and microbial and fine-root biomass in areas with feral swine rooting, but the impact disappeared 2 years after the initial event (Risch et al. 2010). Wirthner et al. (2011) failed to detect significant differences in microbial biomass, or soil bacterial communities.

Changes in soil conditions and vegetation resulting from feral swine foraging, may impact the types of soil biota which can thrive at a site. Soil micro-invertebrates declined up to 80% in feral swine rooted plots in Great Smokey Mountains National Park (Lowney et al. 2005). In Hawaii, feral swine dispersed seeds of the non-native, nitrogen fixing, *Myrica faya* tree in rainforests (Nogueira-Filho et al. 2009). Earthworm abundance increased in areas near invasive *Myrica faya* plants, presumably because of the increased nitrogen near the tree roots. In another study in Hawaii, soil biomass doubled and arthropods increased 2.5 times above initial levels over a 7-year period after feral swine were removed (Vtorov 1993). Mohr et al. (2005) documented declines in predatory soil arthropods in areas damaged by feral swine.

Feral swine may help to move mycorrhizea, which can help with genetic mixing of mycorrhizea species. Génard et al. (1988) identified several types of mycorrhizal fungi in the feces of wild boar in France. The authors hypothesized that wild boar may play a role in dispersal and colonization of the fungi, and may have a beneficial impact on forest regeneration. However, feral swine can also distribute harmful or non-native fungi. On Isla Victoria, Argentina, feces from feral swine and introduced deer also appear to be dispersing mycorrhizal fungi necessary for the growth of non-native pines, enabling the unwelcome spread of pine on the island (Nuñez et al. 2013). Feral swine are also believed to spread the fungus *Phytophthora cinnamoni* which causes root rot in native Hawaiian vegetation (Kliejunas and Ko 1976).

Feral are known to forage on fungi (Ballari and Barrios-Garcia 2014), but the extent to which feral swine impact fungi populations and use of fungi by people and native wildlife has not been well documented, particularly in the U.S. In a study of feral swine foraging in forest communities of Queensland, Australia, Laurance and Harrington (1997) noted that wet sclerophyll forests had the greatest amount of rooting by feral swine. The authors noted that fungi may be a significant component of feral swine diets in this forest type because most sclerophyllous trees are associated with mycorrhizae which form edible fruiting bodies. The authors expressed concern that foraging by feral swine may result in competition with native species including an endangered northern bettong (*Bettongia tropica*). In

Italy, fruiting bodies of summer truffles (*Tuber aestivum*) increased significantly in areas where fences were installed to exclude wild boar (Salerni et al. 2013)

### *b. Vegetation*

Vegetation is the primary component of feral swine diet, and is among the most extensive and commonly documented forms of feral swine damage (Seward et al. 2004, Campbell and Long 2009, Nogueira-Filho et al. 2009, Barrios-Garcia and Ballari 2012, Ballarli and Barrios-Garcia 2013, Stankus 2014). National wildlife refuges strive to conserve, manage, and where appropriate, restore the fish, wildlife, and plant resources and their habitats.

Feral swine impact plants directly through consumption of underground plant parts (e.g., roots, tubers), seeds and vegetation, uprooting plants while seeking other underground forage, rubbing on trees, and trampling (Campbell and Long 2009, Mayer *2009*a, West et al. 2009). For example, hard mast (e.g., acorns, beechnut, hickorynut) is a preferred food source of feral swine when available, and consumption of these seeds can reduce forest regeneration. Selective foraging can result in shifts in plant species abundance and plant community composition (Barrios-Garcia and Ballari 2012). Foraging on seeds, tubers and young plants can also alter the successional stage of plant communities and associated ecosystem services (Lowney et al. 2005, Campbell and Long 2009, Barrios-Garcia and Ballari 2012). Although there are some exceptions (see below), the cumulative impacts of feral swine foraging also tend to result in reduced plant species diversity (Kotanen 1995, Hone 2002, Barrrios-Garcia and Ballari 2012, Boughton and Boughton 2014).

Feral swine do not use all ecosystem types equally, and the extent to which any given ecosystem can withstand and recover from feral swine foraging varies; even fairly similar systems can respond very differently to feral swine damage (Cushman et al. 2004, Barrios-Garcia and Ballari 2012). Plant communities adapted to disturbance may be more likely to sustain and recover from feral swine foraging (Baron 1982, Kotanen 1995).

Habitat damage is particularly important in wet areas where plant communities and soils are more vulnerable to disturbance (Chavarria 2007, West et al. 2009). In Hawaiian rainforests feral swine rooting prevented regeneration of young plants and modified forest community structure and composition. Feral swine feeding also reduced populations of native tree ferns and sub canopy cover (Nogueira-Filho et al. 2009). Feral swine appear to have a preference for wetlands and riparian habitats (Mayer 2009*a*). In Big Thicket National Preserve, Texas, there was an average of 28% feral swine damage in three of the management units (Chavarria et al. 2007), although damage varied among management units. In the Big Sandy Creek Unit, damage was greatest in wet and mesic sites with 45% of wetland habitat damaged in comparison to 35% damage on slopes and 4% on uplands. In the Turkey Creek Unit, damage was greatest in flatlands (46%), intermediate in slopes and floodplains (26%) and lowest in uplands (4%). However, in the Lance Rosier Unit, damage was greatest in uplands (33%), followed by slopes (21%), floodplains (15%) and flatland (14%).

On Santa Rosa Island, Channel Islands National Park, California, seven endangered plants and one threatened plant have been impacted by feral swine, including Hoffman's rock cress (*Arabis hofmannii*), Santa Rosa Island manzanita (*Arctostaphylos confertiflora*), soft-leaved paintbrush (*Castilleja mollis*), Island bedstraw (*Galium buxifolium*), Hoffmann's slender-flowered gilia (Gilia tenuiflora hoffmanii), island rush-rose (*Helianthemum greeni*), island barberry (Berberis pinnata ssp. insularis), and island phacelia (*Phacelia insularis* ssp. *insularis*) (Lombardo and Faulkner 2000). Florida's seepage slope habitat, an imperiled form of wetlands characterized by boggy grassy meadows or shrub thickets, is threatened by feral swine (Engeman et al. 2007). Many rare and endemic plants occur in seepage slope habitat. The state-listed endangered white-top pitcher plant (*Sarracenia leucophylla*) occurs in this habitat, and its presence was negatively correlated with swine damage (Engeman et al. 2007b). Other species that are considered indicators of seepage slope health (toothache grass, wiregrass, and herbaceous cover) were also negatively correlated with swine damage (Engeman et al. 2007b). However, in the same study, the state-listed red-flower pitcher plant (*Sarracenia rubra*), was positively correlated with swine damage.

Invasive plant species tend to colonize disturbed areas more readily than native species, and areas disturbed by feral swine are often more vulnerable to invasion by non-native plants (Baron 1982, Seward et al. 2004, Barrios-Garcia and Ballari 2012). Feral swine also facilitate spread of invasive plants though distribution of seed in their feces, even though most seeds consumed by feral swine are digested (Barrios-Garcia and Ballari 2012). Feral swine may also transport seeds in their coats. In Hawaii, feral swine are instrumental in the spread of strawberry guava and *Myrica faya* seeds (Aplet et al. 1991). Additionally, as noted in section C.1.a above, many plant species form symbiotic relationships with mycorrhizae needed for plant growth, and in at least one instance, feral swine facilitated the spread of an invasive plant by spreading the mycorrhizae upon which it depended (Nuñez et al. 2013). Colonization by invasive species can be a more persistent problem because invasive plants often remain after feral swine are removed. In one study from Hawaii, invasive plants persisted in the area 16 years after feral swine had been removed, even though common native plant species had recovered in the area (Cole et al. 2012). It should be noted that although feral swine rooting and feeding can create situations which favor colonization by invasive species, correlation between feral swine damage and invasive species does not necessarily mean that the feral swine were the causative agent. In some situations, areas with invasive species may be more extensively damaged because feral swine were attracted to invasive species or conditions associated with invasive species (e.g., invasive species create soil conditions favorable to invertebrates eaten by swine; Barrios-Garcia and Ballari 2012).

Feral swine can also damage plant communities indirectly through alteration of soil, water, and fungi as discussed above. Plant-soil interactions are extremely important in regulating soil processes and the ecosystem services soil provides (Tierney and Cushman 2006). Feral swine foraging can result in substantial reductions in plant cover, and at least one instance of damage of up to 80% of understory plant cover has been documented (Barrios-Garcia and Ballari 2012). Vegetative cover provides an abundant nutrient supply, buffers the soil environment from temperature extremes, and helps maintain levels of soil moisture. In the southwestern United States, canopies of woody plants modify the microclimate beneath and around them by intercepting precipitation and shading the ground, both of which influence soil moisture and temperature (Breshears et al. 1998). Different plant characteristics have been shown to have significant effects on levels of soil organic matter and nutrients (Vinton and Burke 1995). Vegetation type and diversity also influences the rate of soil respiration, or the release of carbon dioxide from the soil. Proper soil respiration is required to support the growth of plants, the maintenance of soil biota, and nutrient cycling.

Feral swine foraging may have beneficial impacts in some ecosystems. In California grasslands, native plant species diversity was 24% higher in plots with feral swine (Cushman et al. 2004). Unfortunately, invasive plant species diversity also increased 29% in swine damaged sites. Biomass of native perennial grasses was not affected by feral swine foraging but biomass of exotic perennial grasses was reduced 56% in plots dominated by native perennial bunchgrass. Feral swine foraging did not change biomass of invasive species in plots dominated by annual grasses and forbs. Biomass of exotic annual grasses increased 80% in patches dominated by bunchgrass but decreased 56% in patches dominated by annual grasses and forbs. Cushman et al. (2004) hypothesized that the differences may have been attributable to differences in plant community response to reduced competition and the ability of species to colonize disturbed sites. In a related study of plant community recovery from feral swine damage after feral swine exclusion, exotic plant species richness rebounded quickly while native species richness was slower to recover (Tierney and Cushman 2006). In a study conducted in Hawaii, the invasive shrub, *Psidium cattleianum*, increased in areas fenced to exclude feral swine (Cole et al. 2012).

Ultimately, although some positive responses to feral swine foraging have been documented, most scientists have concluded that any benefits were exceeded by the adverse impacts of feral swine on other ecosystem components, including continued invasion by invasive plant species (Cushman et al. 2004, Tierney and Cushman 2006, Bevins et al. 2014, Stankus 2014).

### *c. Wildlife*

Feral swine primarily impact wildlife through adverse impacts on habitat as discussed above. Rooting by feral swine destroys habitat for tunneling and ground dwelling organisms including frogs, salamanders, voles, mice, ground squirrels, chipmunks, and birds (Barrios-Garcia et al. 2014). Changes in plant community succession adversely impact a wide range of species that may be dependent upon a specific seral stage of habitat. In Hawaii, damage to understory vegetation reduces the amount of nectar available for birds (Nogueira-Filho et al. 2009). In Tennessee's Great Smoky Mountain National Park, red-backed voles and northern short-tailed shrews were common in plots with little to no feral swine activity, but absent from intensively rooted stands (Singer et al. 1984). The voles build surface tunnels between the ground and leaf litter and declines in their presence was likely attributable to habitat loss. Declines in shrews may have been attributable to a combination of habitat (cover) loss and a decline in the number of invertebrates for food.

Diets of feral swine overlap with many native wildlife species. In some areas these overlaps may result in competition for limited resources. In portions of the south where there are tens or hundreds of thousands of feral swine, the total food demand is substantial and diminishes the overall carrying capacity of native habitats. The FWS has stated that on National Wildlife Refuges in the Southeast United States, feral swine are consuming the bulk of the natural foods produced on the refuges. Feral swine prefer mast crops (nuts such as acorns, hickory nuts, beechnuts) that are also a high value food used by native species such as deer, turkey, and squirrels. Studies documenting impacts of this competition for resources are limited. However, Gabor and Hellgren (2000) observed 5-8 fold higher collared peccary densities in areas without feral swine indicating that the feral swine may be displacing the peccary. Other evidence of competition between feral swine and wildlife exists for squirrels and black bear, deer, turkey, and cranes (Barrios-Garcia and Ballari 2012).

Feral swine have been known to prey on small mammals, young of larger animals, ground-nesting birds (and their eggs and chicks), reptiles and amphibians, crustaceans, snails, insects and other arthropods (Barrios-Garcia and Ballari 2012). Information on the extent to which animals were scavenged or live when obtained by the feral swine is not available from swine diet analyses because the status of the animal at the time it was consumed can rarely be determined based on stomach contents. Consequences of predation vary depending upon the species. Impacts are greatest for T&E species which are already experiencing a wide range of environmental challenges. In the Southeastern United States, feral swine nest predation has become a significant limiting factor for federally-listed T&E tortoises with predation rates as high as 80% in some regions of Florida (West et al. 2009).

Tortise species affected included loggerhead (*Caretta caretta* – threatened), green (*Chelonia mydas* - endangered), leatherback (*Dermochelys coriacea* - endangered), hawksbill (*Eretmochelys imbricata* - endangered), and Kemp's Ridley (*Lepidochelys kempii* - endangered; USDA 2002). A survey of Louisiana alligator farmers who were permitted to collect eggs from the wild indicated an increasing trend in alligator (*Alligator mississippiensis*) nest predation by feral swine (Elsey et al. 2012). Survey respondents reported 590 destroyed nests on 36 separate properties. Similarly, ground nesting birds such as quail, waterfowl, and even penguins have been impacted by feral swine predation (Barrios-Garcia and Ballari 2012). In Texas in 1993, Tolleson et al. (1993) documented feral swine predation on 28% of artificial quail nests. Feral swine are also adversely impacting nest success of wild turkey and bobwhite quail in some portions of the United States (Seward et al. 2004). In a study conducted at Fort Benning west-central Georgia and east-central Alabama, Jolley et al. (2010) estimated that 68 feral swine sampled had consumed 64 reptiles and amphibians from 5 species over an estimated 254 hours of foraging. Extrapolating data from their findings, the authors estimated that the entire population of wild pigs at the Fort Benning could consume up to 3.16 million reptiles and amphibians per year.

Changes in water quality and microbial communities can have consequences throughout the aquatic food chain. In a Louisiana study by Kaller and Kelso (2006), increases in riparian disturbance and associated erosion, fecal coliform bacteria and biochemical oxygen demand in feral swine-damaged sites caused a decrease in insects and freshwater mussels and a shift to a community dominated by gastropods (snails). Long term consequences of losses in collecting and scraping insects and mussels may include interruption of nutrient cycling and energy transfer within the systems. Shifts in aquatic invertebrate community composition and water quality are also likely to impact vertebrates which feed on these species. Many species of fish and mussels, including T&E species may be affected by feral swine activity. For example, clubshell (*Pleurobema clava* – endangered), rabbitsfoot (*Quadrula c. cylindrica* – threatened) and snuffbox mussels (*Epioblasma triquetra* - endangered) occur in small streams which could be impacted by feral swine. They require clear water and sand or gravel substrates. The siltation and water contamination associated with feral swine rooting can result in loss of habitat for these species. In Hawaii, areas with feral swine have higher levels of mosquitos believed to be important for disease transmission in wild birds (*Culex* spp.; Nogueria-Filho et al. 2009). The mechanism for this impact is subject to some debate but appears to be related to feral swine foraging on tree fern trunks that increases the availability of water pools in the tree fern trunks. These pools are among the most abundant and productive habitats for larval mosquitos.

As noted in the section on Agriculture above, feral swine can carry a number of diseases of significance to agriculture. Some of these diseases are also transmissible to and a concern for wildlife (Bevins et al. 2014). For example, pseudorabies has also been detected in native wildlife including raccoons, foxes, and skunks and is usually fatal (Wisely 2014, Pederson et al. 2013,SCWDS 2004). Wildlife usually becomes exposed to pseudorabies when they prey on feral swine or eat feral swine gut piles left by hunters. Pseudorabies does not general persist in wildlife because animals succumb to the disease so rapidly that they rarely transmit the disease. However, reports of pseudorabies in wildlife are rare, and impacts on wildlife populations are unknown. As of 2014, at least four endangered Florida panthers have been confirmed to have died from pseudorabies infections, and another 14 were suspected to have died from pseudorabies infections likely contracted by eating feral swine (Glass et al. 1994).

Feral swine are prey for a range of native wildlife species, particularly while young. In situations where prey is a limiting factor for a species, the presence of feral swine may help support enhanced predator populations. Although the availability of swine as prey may have benefits to predators including eagles, the abundance and distribution of a non-native food source can cause an imbalance between predator populations and native prey. On the northern California Channel Islands, the presence of an abundant feral swine population supported a breeding population of golden eagles, a species that had formerly been a transient in the area. The eagle population increase and associated predation drove populations of three native subspecies of island fox (*Urocyon litoralis*) to near extinction on the northern California Channel Islands (Collins et al. 2009). Likewise, the relationship between the endangered Florida panther (*Puma* (=*felis*) *concolor coryi*) and feral swine is not without its complication. Although feral swine can be a valuable food supply for the panthers, feral swine in Florida also carry the disease pseudorabies that is known to kill Florida panthers (Pederson et al. 2013).

### *d. Climate Change*

The State of the Climate in 2012 report indicates that since 1976, every year has been warmer than the long-term average (Blunden and Arndt 2013). Global surface temperatures in 2012 were among the top 10 warmest years on record with the largest average temperature differences in the United States, Canada, southern Europe, western Russia, and the Russian Far East (Osborne and Lindsey, 2013). Impacts of this change will vary throughout the United States, but some areas will experience air and water temperature increases, alterations in precipitation, and increased severe weather events.

The distribution of a plant or animal species is often dictated by temperature and precipitation. According to EPA (2013b), as temperatures continue to increase, the habitat ranges of many species are moving into northern latitudes and higher altitudes where temperatures are more conducive to their survival. In the case of feral swine, this may result in range expansion. Additionally, the warming trend in the United States could further influence the reproductive success of feral swine by ensuring abundant food sources in an increasing number of areas.

In Hawaiian native forests, researchers determined that feral swine influence soil respiration, which can subsequently impact terrestrial carbon cycling (USDA, 2013c). However, the impact of feral swine in context of other factors contributing to climate change is unclear. In general, feral swine are not expected to have a substantive direct impact on climate change, but adverse impacts of feral swine may be aggravated in ecosystems and for species stressed by climate change. The cumulative impact of damage from feral swine in a growing number of ecosystems already stressed from climate change may cause irreversible ecological changes and can contribute to species extinctions (Fischlin et al. 2007).

## 2. Resources That May be Affected by Feral Swine Damage Management

### *a. Impacts Associated with Elimination or Reductions in Feral Swine Populations*

As noted above, feral swine can cause substantial adverse impacts on natural resources, individual native species and ecosystems. In areas were feral swine cause adverse impacts, measures that reduce or eliminate feral swine populations are generally expected to have beneficial impacts. For example, in Florida, one year of a feral swine damage management program reduced damage to the last remnant of a basin marsh ecosystem in the state, with 91% of transects showing damage prior to the start of the program and only 31% of transects showing damage after the first year of damage management (Engeman et al. 2004). Both hunting and professional feral swine removal helped to reduce damage to endangered seepage slope habitats in Florida, with professional feral swine removal activities also having peripheral benefits on adjacent areas with hunting but no FSDM program (Engeman et al. 2007b). On Cayo Costa Island in Florida, removal of raccoons and feral swine reduced predation on sea turtle nests from 74% before predator removal to 15-16% after predator removal (Engeman et al. 2010). Least tern (*Sterna antillarum*) nest success went from no terns produced prior to predator removal to 31 and 20 terns per year in the two years after the start of predator removal. Feral swine exclosures at some nesting areas in Puerto Rico were helpful in protecting Mona ground iguana nests and allowed hatching to occur. At Pinnacles National Monument in California, building an exclosure and eradicating all the swine within it eliminated adverse effects to the habitat of the California red-legged frog and California tiger salamander (McCann and Garcelon 2008).

Removal of feral swine may less the damage, but may not, in and of itself, result in recovery of the system. Additional restoration efforts may be needed, particularly in areas where invasive plant species have become established. For example, once established, non-native plant species often outcompete native species, and additional intervention may be needed to remove the invasive plants. Exclosure studies in Hawaii have shown that removal of feral swine can result in the recovery of native species but it does not necessarily impact richness of non-native species that have become established during the period of feral swine disturbance (Nogueira-Filho et al. 2009). Tierney and Cushman (2006) documented that although species richness of native plants in a northern California coastal grassland recovered after feral swine disturbance, richness of exotic species rebounded much more rapidly. They did not observe a substantial decline in invasive species over the 5 years of their study although there was variation among native plant types in ability to recolonize in the presence of invasive species. Some plant communities may need an extensive period to recover. Rejmánek (1989) documented a decline in dominance of invasive species over a 50-60 year periods.

Loss of Potential Benefits from Feral Swine

As discussed above, in very limited circumstances, feral swine can have positive impacts on natural resources. However, these benefits are usually not without adverse consequences. For example, feral swine are food for Florida panthers, but feral swine in Florida also carry pseudorabies that can kill panthers and other native wildlife. Feral swine may create conditions favorable to growth by some types of plants, but they also facilitate distribution of non-native invasive plants. In general, the collective adverse impacts of feral swine on the human environment outweigh potential positive impacts.

Potential benefits of feral swine need to be considered in context of the baseline conditions of the system in question. For example, increases in soil nutrients may be beneficial to plant growth, but in an ecosystem with plants adapted to nutrient poor soils, increased nutrients could favor non-native species over native species or result in shifts in plant community composition. Furthermore, ecosystems in the United States and territories did not evolve with feral swine. The native systems they impact are or were able to function in a healthy sustainable way without feral swine. Consequently, it may be possible or, potentially more desirable, for managers to seek to achieve any benefits that may result from feral swine through efforts to enhance native systems and species (Cushman et al. 2004, Tierney and Cushman 2006, Bevins et al. 2014, Stankus 2014).

### *b. Potential Impacts of FSDM Methods*

Some FSDM activities, although intended to reduce adverse environmental impacts over the long-term, can have the potential for limited and localized adverse impacts on natural resources. These impacts may include trampling and soil compaction associated with site access, disturbance of wildlife, and unintentional capture, injury or death of wildlife in devices intended to capture feral swine. Impacts of the existing program on natural resources are provided in Chapter 4. Three key federal laws are particularly relevant in consideration of impacts of a FSDM program on Natural Resources: the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Details on each of these laws and their relationship to FSDM are provided below.

Threatened and Endangered Species

Section 7 of the Endangered Species Act of 1973, as amended ((ESA) 16 USC 1531-1543), requires each federal agency to ensure that its actions will not jeopardize the continued existence of listed species or destroy or modify such species' critical habitat. If one or more protected species may be affected within the area of a proposed action, then the agency must determine whether and how the action will or could potentially affect such species. If a "may affect" determination is made, the agency must consult with the FWS to determine whether the action is likely to adversely affect or jeopardize the continued existence of the species. If FWS determines that the proposed action is likely to adversely affect or jeopardize the continued existence of a protected species, the agency must avoid or mitigate the proposed action so that the adverse action is avoided or the adverse impact is reduced to an acceptable level. This DEIS provides a framework for local level consultations, discusses potential effects of program activities, and determines when consultation could be necessary. The potential effects from APHIS-WS FSDM actions are summarized in Appendix G and are discussed in detail in Chapter 4 Section C.1.

Migratory Birds

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712) established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird. USFWS released a final rule on November 1, 2013 identifying 1,026 birds on the List of Migratory Birds (USFWS, 2013). Species not protected by the Migratory Bird Treaty Act include nonnative species introduced to the United States or its territories by humans and native species that are not mentioned by the Canadian, Mexican, or Russian Conventions that were implemented to protect migratory birds (USFWS, 2013).

Executive Order 13186 directs Federal agencies taking actions with a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS that promotes the conservation of migratory bird populations. On August 2, 2012, a Memorandum of Understanding between APHIS and the USFWS was signed to facilitate the implementation of this Executive Order. The Memorandum of Understanding provides APHIS with guidance to avoid and minimize, to the extent practicable, detrimental migratory bird habitat alteration or unintentional take during management activities.

General migratory bird stressors associated with FSDM may include things such as disturbance of nesting birds by biologists, their vehicles frightening devices or dogs used in FSDM, habitat disturbance during site access, unintentional take or injury of birds in devices intended to capture feral swine and risks associated with the use of lead ammunition. These risks are summarized in Appendix F, and discussed in Detail in Chapter 4 Section C.2.

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) prohibits the take of bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles unless permitted by the Department of the Interior. The term "take" in the Act is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Disturb is defined as any activity that can result in injury to an eagle, or cause nest abandonment or decrease in productivity by impacting breeding, feeding, or sheltering behavior.

Bald eagle populations occur in the lower 48 States and Alaska and have rebounded in the last few decades. Golden eagles are located mostly in the western half of the United States. Survey data from 2006-2009 indicate that there is a stable golden eagle population in four Bird Conservation Regions in the West, with a possible decline of juvenile golden eagles in the southern Rocky Mountains (FWS 2011).

Unintentional take of bald or golden eagles could occur from the following proposed methods for FSDM: disturbance from firearms and pyrotechnics and unintentional capture, injury or death in devices set to capture feral swine. Exposure to lead shot and bullets also is a concern if feral swine carcasses are left in eagle areas. Potential risks to eagles are summarized in Appendix F and discussed in detail in Section C.2.

## D. Property

### 1. Resources Affected by Feral Swine

#### *a. Landscaping, Gardens, Golf Courses, Urban Parks/Recreational Areas, Roads, Levees, Dikes*

As populations of feral swine have spread and increased in size they have also begun to expand into new habitats not previously occupied (Extension 2012*c*) including urban and suburban environments. Feral swine can cause significant damage in suburban/urban areas with their foraging activities. The most common foraging impact observed is rooting. In urban areas this type of damage primarily affects grassed areas such as residential lawns, parks, golf courses, sports fields, cemeteries, and levees/dikes. In addition to the damaged turf, rooting can also cause other physical impacts to the affected landscaping areas (erosions, slope failure, down-grade sedimentation). Foraging by feral swine in developed areas can also result in the depredation of ornamental species planted in landscaped areas. Further depredation impacts by feral swine have been observed in backyard fruit and vegetable gardens (Extension 2012*c*). Feral swine have also been observed to disperse garbage and refuse as a result of their foraging activities, creating both litter and sanitary issues (Extension 2012*c*). Additionally, rooting damage to levees and dikes caused by feral swine leaves the soil vulnerable to being washed away during a flood (SEAFWA 2012) and increases risk of flooding damage. In addition to costs associated with repair and prevention of feral swine damage to property, feral swine damage can adversely impact property values. Conversely, the presence of feral swine may be considered a positive impact on property values in areas where feral swine hunting is desired and permitted by law.

Feral swine can damage lawn irrigation and sprinkling systems by digging up and breaking the piping associated with these systems to get at the water contained in the lines. There have been instances of feral swine entering commercial businesses or private residences. Feral swine can cause significant property damage trying to escape from confined surroundings (Extension 2012 *c*).

***b. Vehicle Collisions***

Feral swine collisions with vehicles are known to occur in the United States (Thompson 1977, Synatzske 1993, Mayer 2005). As the numbers of feral swine have increased, the frequency of feral swine-vehicle collisions has increased concurrently (Mayer and Brisbin 2009, Burns 2009, Mildenburg 2012). Mayer and Johns (2011) collected data from 179 feral swine-vehicle collisions in South Carolina occurring between 1968 and 2006 (Mayer and Johns 2011). Those accidents collectively involved 212 feral swine. The study found that feral swine-vehicle collisions occurred year-round and throughout the 24-hour daily time period. Most accidents were at night and the presence of lateral barriers was significantly more frequent at collision locations. Collisions with feral swine are most common in areas of preferred feral swine habitat. An evaluation of 311 wild pig-vehicle collisions in South Carolina determined that collisions were more likely in areas closer to streams and with less pine forest than would occur if collisions were randomly distributed (Beasley et al. 2013). As discussed in section G.1.a, human injuries were infrequent but potentially serious. The mean vehicle damage estimate was $1,173 (Mayer and Johns 2011). The projected cost of vehicle collisions with feral swine in the United States could be as high as $36 million annually (Mayer and Johns 2011).

In addition to collisions with automobiles and motorcycles, feral swine have also been involved in collisions with trains and aircraft. Feral swine collisions with trains have been documented to occur in North America, Western Europe, and Asia. In 1988, two feral swine crossing a runway at the Jacksonville International Airport collided with an F-16 fighter jet that was attempting to take off, destroying the $16 million aircraft in the subsequent crash (Extension 2012*b*).

**c. Pets**

Unexpected, sudden encounters with feral swine in suburban areas have resulted in attacks of humans and their pets. Such incidents are rare, but increasing. Feral swine are potentially dangerous animals and can be very aggressive when they feel either threatened or cornered. The presence of dogs being walked by their human owners has been suggested to represent a hazard with respect to instigating feral swine attacks (Extension 2012*c*). Several reports document attacks, some fatal, by feral swine to domestic pets (Sanchez 2011, Burkhart 2012, Billi 2013).

## 2. Resources Which May be Affected by Feral Swine Damage Management

Effective FSDM programs are anticipated to result in reduced feral swine damage to property and threats to pets. Most FSDM methods are not expected to pose any risks to property, however there may be concerns regarding concentrated feral swine damage within corral/cage traps. These traps are generally placed in areas already disturbed by swine, so additive impacts are likely minimal. There may also be concerns regarding the use of pyrotechnics in areas where environmental conditions increase risks of fire. As with all APHIS-WS methods risks can be minimized or avoided through compliance with applicable laws and regulations, staff training, and the implementation of SOPs and specific APHIS-WS directives and safety guidelines for those methods.

Pets could potentially be impacted by some methods employed during FSDM. Potential risks to pets and the environment from the proposed use of APHIS-WS methods are evaluated in Chapter 4. The use of snares, pyrotechnics for hazing, cage and foothold traps, drugs, carcass disposal and reproductive inhibitors could pose safety concerns for domestic animals. Many of these risks will be minimized or avoided through compliance with applicable laws and regulations and the implementation of SOPs and specific APHIS-WS directives and safety guidelines for those methods. Primary risks to pets associated with these methods include risk of unintentional capture, injury or mortality in snares, foothold traps or, less commonly, live-traps. There may also be concerns regarding risks to pets which may be frightened by the use of pyrotechnics. An analysis of current risks of FSDM can be found in Chapter 4.

# E. Socio-cultural Resources

## 1. Resources Affected by Feral Swine

### a. ***Historic Sites/Resources***

Rooting and foraging by feral swine can damage archaeological sites and resources through mechanical disruption of soil profiles essential for dating and understanding the context of archaeological information. Swine rooting also increases the vulnerability of a site to erosion, further threatening the integrity of buried historic resources. A study conducted at Avon Park Air Force Range in Florida quantified the potential for feral swine damage to historical sites on the over 98,000 acres of land on the base (Engman et al. 2012). Thirty-six sites registered with the Florida State Historic office and eligible for inclusion in the National Register of Historic places were examined for evidence of swine impacts and potential vulnerability to swine (defined as presence of historic resources within the range of rooting depth for swine). As part of the study, the "Dead Cow" prehistoric cultural complex was also examined for evidence of feral swine damage. This site has been identified as potentially being one of the most significant prehistoric sites in the Okeechobee/Belle Glade archaeological area (Engeman et al. 2013b). Fifteen of the 36 historic sites had some level of swine disturbance including 14 of the 30 sites known to have artifacts within 8 inches of the surface – a depth well within the rooting range of swine. At the prehistoric site, swine rooting was documented in the vicinity of 14 of the 19 shovel test points for the project. Damage and damage risks at the prehistoric site were of sufficient concern that the area was fenced at the cost of approximately $18,000 for construction plus a commitment to future maintenance costs to prevent further damage.

Feral swine damage is not limited to buried resources. Other damage to historic resources can include visual and aesthetic damage to historic monuments, battlefields, cemeteries (disturbance of headstones and other monuments), and living-history sites. At sites managed by the NPS, feral swine foraging, rooting and wallowing has resulted in damage to historic structures, soils and vegetation, cultural landscapes and ethnographic resources, and traditional cultural properties (G. Dickison, NPS, Scoping comments on APHIS feral swine EIS).

### b. ***Impacts on Native Americans, Traditional Cultures and Ceremonial Values***

Native Americans

Native American Tribal interactions with and attitudes toward invasive species can be complex and tribal perceptions of feral swine and feral swine impacts vary among tribes and between individuals within tribes depending on their history with the species. During the scoping phase for the DEIS, the Osage Nation of Oklahoma reported difficulties with feral swine damage to tribal archaeological sites similar to those noted above. Feral swine damage has the potential to remove or jeopardize the viability of local plants, animals and fungi used for traditional purposes. For example, Wiles (2005) reported that feral swine damage was reducing populations of breadfruit tree, a traditional food source on Guam and the Mariana Islands. For some tribes, the visual damage, changes in plant species composition, introduction of invasive species, and impacts on wildlife associated with the presence of feral swine are an undesirable impact on the Tribe's relationship with and stewardship of the natural world. The presence of a foreign species can also be a highly undesirable intrusion in tribal sacred sites.

Not all tribal relations with feral swine are negative. In scoping for the EIS, the Seminole tribe of Florida noted that feral swine have been present in Florida for a long time and have become a part of Tribal culture and have positive and negative impacts on Tribal lands (Craig D. Tepper, Seminole Tribe of Florida, Scoping comment on APHIS feral swine EIS). Feral swine are used for food by tribal members and are valued a game animal. Feral swine are also a prey item for the federally-listed endangered and tribally-valued Florida panther. Consequently, the tribe works to sustain feral swine populations at a manageable level and expressed a desire to retain feral swine populations for tribal use.

<u>Native Hawaiian and Pacific Islands Cultures</u>

Swine, including feral swine, play an important part in culture, traditions and ceremonies of the people of Hawaii and the Pacific Islands, particularly in areas where swine arrived with the first human settlers. Swine feature prominently in traditional meals and in some areas may still play a role in traditional perceptions of status and wealth. In addition to ceremonial purposes, feral swine are used by some families as an affordable source of food. State and Territorial governments in these areas usually manage feral swine as a game species with the intent to maintain swine for ongoing use by local population. Although swine in these areas have a high cultural value, people in these areas also experience damage by and conflicts with swine. Damage management efforts in these areas must balance the uses of swine with the need to reduce damage. For example, the current FSDM program in Hawaii, APHIS-WS does not remove feral swine from public hunting areas. Feral swine are removed from agricultural areas and private lands primarily, where they are damaging crops, property and other resources. In other areas where the community surrounding a national park supports the presence of feral swine, the NPS has elected to use fencing as a means to protect valuable resources (e.g., National Park of American Samoa).

### *c. Hunting*

Due to their size, ability to detect and avoid hunters, and reputation for aggressive behavior, feral swine are a prized game species. Guided hunts can be highly profitable businesses and likely have indirect economic benefits to local communities (impact on hunting preserves addressed in Section 2.a above). For states which require licenses to hunt swine, swine hunting can provide substantial revenue for wildlife management. For example, in California, the State generated over five million dollars in revenue from sale of tags for feral swine hunting (Kreith 2007). Unfortunately, increased interest in feral swine hunting is also likely one of the primary contributors to the recent rapid spread of feral swine (Bevins et al. 2014). Illegal movement of swine has occurred as individuals transport and release feral swine to create local hunting opportunities. In some areas unexpected expansion in the feral swine population has occurred when states have created feral swine hunting seasons with the intent of getting the public to help contain swine populations. Hunters have transported swine to their previously unoccupied areas in order to create local hunting opportunities. In Tennessee, feral swine populations were relatively stable and confined to only a few counties from 1950s through 1980s. A state-wide, year-round hunting program with no limits on the number of animals harvested was instituted in 1999. Populations have expanded rapidly since that time and in 2011, nearly 70% of counties had pockets of feral swine (Bevins et al. 2014). A similar pattern was observed in California, and Waithman et al. (1999) stated that the interest among landowners in establishing or augmenting populations on private land was the single most important human-related factor in feral swine population expansion in the state.

Not all hunters perceive feral swine as an asset. As noted above, in the section on impacts to natural resources, feral swine can adversely impact native species and their habitat and adversely impact associated hunting opportunities. Feral swine prey on popular native game species including deer fawns, and eggs of ground-nesting birds such as waterfowl, turkeys, and quail. Feral swine activity and habitat impacts may alter movement patterns and space use of native wildlife which can also impact hunting opportunities. Feral swine wallows and erosion resulting from soil disturbance and vegetation loss associated with feeding by swine can adversely impact water quality and associated fishing opportunities.

### *d. Other Outdoor Activities*

Each year, millions of Americans and visitors to the United States and Territories participated in outdoor recreation. Similarly, a national survey by the Outdoor Foundation of indicated that in 2012, nearly half of all Americans (approximately 142 million people) age 6 and older participated in some form of outdoor recreation. These individuals participated in approximately 12.4 billion outdoor excursions. The most popular activities by participation rate and favorite outdoor activities by frequency of participation are listed in Tables 3-8 and 3-9. The extent to which feral swine can impact the resources viewed or enjoyed by individuals participating in a specific outdoor recreation activity varies, but activities such as hiking, bird and wildlife watching, fly fishing, and camping are among those most likely to be impacted by the presence of feral swine. Some individuals may enjoy opportunities to view free-ranging swine, but others may perceive the presence of non-native "livestock" as an adverse impact on their recreational enjoyment of an area. However, physical damage to the environment cause by feral swine has the potential to adversely impact recreational enjoyment of the outdoors. Habitat changes, direct predation and disturbance by feral swine also have the potential to adversely impact wildlife movements and distribution and associated opportunities for wildlife viewing. Adverse impacts may be particularly acute for individuals who encounter swine when recreating in wilderness areas and other sites specifically intended to preserve native systems in a condition with minimal disturbance by people.

**Table 3-8.** Most popular outdoor activities for Americans age 6 and older by participation rate as identified in 2012 identified in an Outdoor Association (The Outdoor Foundation 2013)

| Activity | Estimated Proportion of Population that Participates | Estimated Number of Participants (Millions) |
|---|---|---|
| Running, Jogging and Trail Running | 19% | 53.2 |
| Freshwater, Saltwater and Fly Fishing | 16% | 46.0 |
| Road Biking, Mountain Biking and BMX | 15% | 42.3 |
| Car, Backyard and RV Camping | 13% | 38.0 |
| Hiking | 12% | 34.5 |

Feral swine have habituated to the presence of people and may be readily viewed in some parks and recreational areas. This opportunity to see free-ranging animals, even if they are not native species, is valued by some individuals. These individuals may also enjoy feeding swine at recreational sites, although in most areas the practice is prohibited to reduce risks of adverse interactions between people and habituated swine which may aggressively solicit food from visitors.

**Table 3-9.** Number of outings for favorite outdoor activities for Americans age 6 and older by frequency of participation as identified in 2012 identified in an Outdoor Association (The Outdoor Foundation 2013)

| Activity | Yearly Outings per Person | Total Outings |
|---|---|---|
| Running, Jogging and Trail Running | 87 | 4.6 billion |
| Road Biking, Mountain Biking and BMX | 64 | 2.7 billion |
| Birdwatching and Wildlife Viewing | 46 | 1.2 billion |
| Freshwater, Saltwater and Fly Fishing | 22 | 1 billion |
| Hiking | 18 | 6.3 million |

### *e. Feral Swine Related Businesses*

As feral swine populations and associated damage have increased, so have businesses to aid landowners and managers in managing damage. These businesses include feral swine removal and damage management consultation services, and businesses which provide supplies for FSDM including corral traps, trap monitoring systems. Some of these businesses are new enterprises committed solely to FSDM while others will be expansions of existing services (e.g., companies finding new markets for existing goods and services). While information on the existence of these businesses is readily available through a review of the internet, there are no studies evaluating the economic scale or impact of FSDM related businesses.

### *f. Humaneness and Ethical Concerns*

Ethical Concerns

Ethics can be defined as the branch of philosophy dealing with values relating to human conduct, with respect to the rightness or wrongness of actions and the goodness and badness of motives and ends (Costello 1992). Individual perceptions of the ethics of wildlife damage management and the appropriateness of specific management techniques depend on the value system of the individual. These values are highly variable (Schmidt 1992, Teel et al. 2002), but can be divided into some general categories (Kellert and Smith 2000, Kellert 1994 Table 3-10). An individual's values on wildlife may have components of various categories and are not restricted to one viewpoint. The tendency to hold a particular value system varies among demographic groups.

Views on ethics of wildlife management also often contain an emotional component that can be variable depending on location and species being considered, can change over time, or can be inconsistent (Haider and Jax 2007, Littin et al. 2004). Various types of viewpoints can influence ethics and value systems. For example, one major factor influencing value systems is the degree of dependence on land and natural resources as indicated by rural residency, property ownership and agriculture or resource dependent occupations (Kellert 1994). People in these groups tend to have a higher tendency for utilitarian and dominionistic values. Socioeconomic status also influences wildlife values with a higher occurrence of naturalistic and ecologistic value systems among college educated and higher income North Americans (Kellert 1994). Age and gender also influence value systems with a higher occurrence of moralistic and humanistic values among younger and female test respondents (Kellert 1980, 1994).

**Table 3-10.** Basic wildlife values. [Taken from Kellert and Smith (2000) and Kellert (1994)].

| Term | Definition |
|---|---|
| Aesthetic | Focus on the physical attractiveness and appeal of large mammals |
| Dominionistic | Focus on the mastery and control of large mammals |
| Ecologistic | Focus on the interrelationships between wildlife species and natural habitats |
| Humanistic | Focus on emotional affection and attachment to large mammals |
| Moralistic | Focus on moral and spiritual importance of large mammals |
| Naturalistic | Focus on direct experience and contact with large mammals |
| Negativistic | Focus on fear and aversion of large mammals |
| Scientific | Focus on knowledge and study of large mammals |
| Utilitarian | Focus on material and practical benefits of large mammals |

Many philosophies on human relationships with animals can be considered relative to ethical perceptions of wildlife damage management techniques. Some of the more prevalent philosophies are discussed here, although there may be others that influence wildlife management decisions.

One philosophy, animal rights, asserts that all animals, both human and nonhuman, are morally equal. Under this philosophy, no use of animals (for research, food and fiber production, recreational uses such as hunting and trapping, zoological displays and animal damage management, etc.) should be conducted or considered acceptable unless that same action is morally acceptable when applied to humans (Schmidt 1989).

Another philosophy, animal welfare, does not promote equal rights for humans and nonhumans, but focuses on reducing pain and suffering in animals. Advocates of this philosophy are not necessarily opposed to utilitarian uses of wildlife but they are concerned with avoiding all unnecessary forms of animal suffering. However, the definition of what constitutes unnecessary is highly subjective (Schmidt 1989). In general, only a small portion of the U.S. population adheres to the animal rights philosophy, but most individuals are concerned about animal welfare.

A third philosophy takes the view that overpopulation of an animal species (whether natural, man-induced, or artificial) leads to increased animal suffering when the population suffers malnutrition, disease outbreaks of epidemic proportion, or populations crashes due to exceeding the environmental carrying capacity. Advocates for this approach suggest that it is man’s obligation to manage animal populations in a manner that reduces potential suffering to a minimal level (Beauchamp and Frey, 2011). Similarly, some individuals may feel that humans have a moral obligation to correct environmental impacts that result from the human introduction of invasive species such as feral swine.

When evaluating issues relating to the ethics of conserving or controlling nature, another approach is to consider the reason for the action as the determination of whether the action is ethical or not. In this approach, one model involves assessing actions from the point of view of humans only (anthropocentric) or from a more general view of all living organisms (biocentric) that considers any harm to living creatures that can be avoided as immoral (Haider and Jax 2007). These approaches have been considered for conservation decisions, but could also be applied to feral swine control decisions such as those discussed in this EIS.

A simple model for determining the ethics of a potential action proposes assessing whether the action is necessary, and whether it is justified. In this model, if "yes" is the answer to both questions, the action is ethical (Littin and Mellor 2005). Although the considerations relating to each of these questions may involve several factors, only the two basic questions need to ultimately be answered using this model.

Yet another approach developed a set of six major criteria that can be used to design a pest control program that is ethically sound (Littin et al. 2004). The six major criteria are:

1. The goals, benefits and impacts of action must be clear.
2. The action should only be taken if goals can be achieved.
3. The most effective methods must be used to achieve goals.
4. The methods must be used in the best ways possible.
5. The goals must be assessed
6. Once goals are achieved, processes should be in place to maintain results.

Using this model, an ideal project is one that follows all six criteria above (a "gold standard" project). If not all can be followed, an ethically sound pest control program can still be conducted if the project is conducted in a way that moves toward to the "gold standard". With unlimited funding and time available, achieving a "gold standard" project may be possible. The challenge in coping with this type of model is how to achieve the best project (as close to the "gold standard" as possible) with the least amount of animal suffering within the constraints imposed by current technology and funding.

Models assigning numerical values to criteria have been proposed to assist in decision-making for alternatives when faced with animal disease outbreaks. One such model attempts to incorporate social ethics as one of the major criteria to be ranked, assigning numerical ranking to issues such as animal welfare (Mourits et al. 2010). Although the primary application of this model is for disease outbreaks, it could also potentially be applied to feral swine control.

The issue of ethics is evolving over time (Perry and Perry 2008) but no one commonly-accepted standard for the evaluation of ethics relating to control of animal pests exists. Any of the above models, alone or in combination, may provide additional consideration of the ethics of a proposed action. APHIS-WS has numerous policies, directives and SOPs that provide direction to staff involved in wildlife control reinforcing the achievement of the most appropriate and effective wildlife damage management program possible. Many of these guidance documents incorporate aspects of the ethics consideration issues discussed above. Directives pertaining to APHIS-WS' activities may be located using the APHIS-WS home page at http://www.aphis.usda.gov/wildlifedamage.

Humaneness Concerns

The issue of humaneness, as it relates to killing or capturing of wildlife is an important but complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. Few premises are more obvious than that an animal can feel pain. Determining whether an animal is experiencing pain or suffering is difficult. Despite this difficulty, many manifestations of pain are shared by many animal species (AVMA 2013). The intensity of pain perceived by animals could be judged by the same criteria that apply to its recognition in human beings. If a condition causes pain in a human being, it probably causes pain in other animals. Suffering is a much abused and colloquial term that is not defined in most medical dictionaries. Neither medical nor veterinary curricula explicitly address suffering or its relief. Therefore, there are many problems in attempting a definition. Nevertheless, suffering may be defined as a highly unpleasant emotional response usually associated with pain and distress. Suffering is not a modality, such as pain or temperature. Thus, suffering can occur without pain; and although it might seem counter-intuitive, pain can occur without suffering (AVMA 2013). The degree of pain experienced by animals that are shot probably ranges from little to no pain to significant pain depending on the nature of the shot and the time until death. Since the connotation of suffering carries with it the connotation of time, it would seem that there is little or no suffering where death comes immediately.

People concerned with animal welfare are concerned with minimizing animal suffering as much as possible, or eliminating unnecessary suffering. The determination of what is unnecessary suffering is subject to debate (Schmidt 1989). Humaneness, as perceived by livestock and pet owners, requires that domestic animals be protected from predators because humans have bred the natural defense capabilities out of domestic animals. Predators frequently do not kill larger prey animals quickly, and will often begin feeding on them while they are still alive and conscious (Wade and Bowens 1982). The suffering apparently endured by livestock damaged in this manner is unacceptable to many people. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently.

When implementing management activities, APHIS-WS evaluates all potential tools for their humaneness, effectiveness, ability to target specific individuals as well as species, and potential impacts on human safety. The American Veterinary Medical Association (AVMA 2013) recognizes that "for wild and feral animals, many recommended means of euthanasia for captive animals are not feasible. The panel recognized there are situations involving free-ranging wildlife when euthanasia is not possible from the animal or human safety standpoint, and killing may be necessary." AVMA states that in these cases, the only practical means of animal collection may be gunshot and lethal trapping, and that personnel should be proficient, and use the proper firearm and ammunition. APHIS-WS policy and operating procedures are in compliance with these guidelines, and the APHIS-WS program recognizes the importance of careful decision-making regarding use of lethal methods.

APHIS-WS supports the most humane, selective, and effective damage management techniques, and would continue to incorporate advances into feral swine control program activities. APHIS-WS' control activities are in concert with AVMA guidelines for euthanasia, developed by the long-standing Panel of Experts convened to evaluate issues relating to euthanasia (AVMA 2013). In addition, APHIS-WS field specialists conducting FSDM are highly experienced professionals, skilled in the use of management methods and committed to minimizing pain and suffering. APHIS-WS has numerous policies, directives and SOPs that provide direction to staff involved in wildlife control reinforcing the achievement of the most humane wildlife damage management program possible. SOPs for APHIS-WS activities may be located from the APHIS-WS home webpage at http://www.aphis.usda.gov/wildlifedamage.

Ethics and humaneness issues relating to each of the alternatives in this EIS are discussed in Chapter 4 of this document (see 4.C.10: Environmental Impacts; Humaneness and Animal Welfare Perspectives).

## 2. Resources Which May be Affected by Feral Swine Damage Management

### *a. Historic Sites/Resources, Native Americans, Traditional Cultures and Ceremonial Values*

Removal and reductions in feral swine populations and implementation of nonlethal FSDM techniques are expected to reduce feral swine damage to historic resources, culturally significant resources and sites, native species hunting and wildlife viewing opportunities and adverse aesthetic impacts on parks and natural areas. In areas were feral swine are valued for traditional or ceremonial purposes, reductions in populations or changes in movements in distribution associated with damage management activities could have adverse impacts on cultural uses of swine. However, adherence to state, territorial and tribal management objectives for feral swine and consultation with tribes and other native peoples should help to reduce risks of adverse impacts.

Conversely, there may also be concerns that FSDM actions conducted adjacent to historic, cultural or tribal sites where FSDM is not permitted due to conflicts with the spiritual value or intended use of the site, may result in feral swine taking refuge in areas where they had not previously occurred. Fencing, while effective in protecting sensitive sites (Engeman et al. 2012), may also have adverse impacts on historic and cultural sites because of visual impacts, impacts on movement of native wildlife or the landscape and soil disturbance associated with fence construction. Noise and site disturbance associated with FSDM and some carcass disposal methods (e.g., on-site burial, leaving on site) also have the potential to adversely impact historic sites/resources, and Tribal and other traditional cultural values and site uses. Compliance with the NHPA and consultation with tribes in accordance with Executive Order 13175 and APHIS Directive 1040.3 and will be needed to prevent or minimize risk of these types of adverse impacts.

***b. Hunting***

Hunters who are concerned about the impact of feral swine on native species populations and hunting opportunities are likely to benefit from FSDM actions and associated reduction or elimination of feral swine populations. Removal or reductions in swine populations can adversely impact individuals who value feral swine hunting. In states that receive license revenues for feral swine hunting, reductions in the feral swine population may adversely affect income. However, information on the net balance between revenue from hunting and overall costs of managing the hunt and addressing feral swine damage is not available. Reductions in feral swine hunting may also adversely impact associated businesses including guides/outfitters, the travel industry, meat packaging plants and other businesses. The extent of the impact will depend largely in the size of the feral swine population and the duration of time it has been in the area and state, territorial and tribal regulations and management goals. In states with low or newly developed feral swine populations and/or regulations prohibiting hunting, impacts on hunting are likely to be minimal. Impacts may be less pronounced in States, Territories, and Tribal lands that seek to retain a feral swine population for cultural reasons and sport harvest.

***d. Other Outdoor Activities***

Removal and reductions in feral swine populations and implementation of nonlethal FSDM techniques are expected to reduce feral swine damage to native species populations, natural sites, and wildlife viewing opportunities, and adverse aesthetic impacts on parks and natural areas. Removal of feral swine may reduce safety concerns for individuals who choose to recreate in areas where feral swine occur and may increase their willingness to use these locations. Conversely, individuals who enjoy seeing free-ranging swine on the landscape, and those who may feel that their aesthetic enjoyment of a site is impaired because of the knowledge that lethal methods may have been used to remove feral swine may be adversely impacted by feral swine removal.

Some damage management methods have the potential to impact outdoor activities through disturbance (noise associated with aerial shooting, ground shooting, or frightening devices), or temporary reductions in access for the protection of human safety during damage management operations (e.g., temporary site closures when shooting or hunting with dogs are used). There may be aesthetic concerns regarding some on site methods of carcass disposal including odor and ground disturbance. Nonlethal methods such as fencing may also have impacts (visual, movement through site) on other outdoor activities.

#### e. Feral Swine Related Businesses

The proposals for a national FSDM program are intended to reduce the range and size of the feral swine population in the U.S. in accordance with State, Territory and Tribal management plans. Initial increases in damage management efforts will likely increase private business opportunities. There may also be opportunities for private-federal partnerships in the development of new management techniques. However, over the long term, reductions in the feral swine population will likely result in reduced FSDM related business opportunities in some areas.

#### f. Humaneness and Ethical Concerns

The proposed alternatives involve manipulating animals and natural systems and the use of lethal damage management techniques. Consequently, there will be varying perceptions of the ethics and humaneness of the proposed alternatives and individual management methods as discussed above in Section E.1.f.

## F. Human Health and Safety

### 1. Impacts of Feral Swine on Human Health and Safety

#### a. Vehicle Collisions

Although the primary threat associated with feral swine-vehicle collision is property (i.e., vehicle) damage as discussed in Section C.3, human injures also occur. Human injures are infrequent, but can be potentially serious. In a study analyzing feral swine-vehicle collisions, Mayer and Johns (2011) collected data from 179 feral swine-vehicle collisions occurring between 1968 and 2006. During this study 3 people were noted as being injured in these accidents including one motorcycle driver with minor lacerations, one car driver with minor injuries to the left arm, and 1 security officer who was fatally injured in a secondary crash.

Feral swine collisions at night are often difficult to avoid. Unlike many other animals, feral swine lack a tapetum lucidum (i.e., reflective layer) behind their retinas (Texas Wild Hog Relief 2013). This makes it very difficult for motorists to detect and react to feral swine in roadways after dark. Additionally, feral swine are large and have a relatively low center of gravity. Consequently, collisions with feral swine represent a serious safety hazard and can result in personal injuries and fatalities (Extension 2012*b*). In 2009, a Florida woman was killed when her vehicle flipped after colliding with a feral swine (Wolf and Bartz 2009). In another recent incident, a Texas family narrowly survived a feral swine collision that caused their vehicle to overturn several times on a high speed highway (KXAN 2013). However, a pet dog did not survive the accident.

### *b. Risk of Disease Transmission (Zoonoses)*

Feral swine carry several diseases that can infect humans (zoonoses) including brucellosis, balantidiasis, leptospirosis, salmonellosis, toxoplasmosis, trichinosis, trichostrongylosis, sarcoptic mange (Seward et al. 2004), tuberculosis, tularemia (Hubalek et al. 2002, Stevens 1996), anthrax, rabies (Luangtongkum et al. 1986, van Leeuwen and van Essen 2002), plague (Burns and Loven 1998), cryptosporidium, giardia, and campylobacter (Jay and Wiscomb 2008). These zoonoses can be transmitted to humans via different exposure routes. For example, human contract brucellosis when blood or other body fluid from an infected animal comes into contact with a person's eyes, nose, mouth, or open wound. Human contract tularemia by direct contact through a wound, eating infected meat, and by ticks and biting flies carrying this disease (USDA-APHIS 2013*a*, Timmons 2011). The NWRC National Wildlife Disease Program (NWDP) conducts nationwide monitoring for disease. The NWRC NWDP conducts nationwide monitoring for diseases of interest to human, livestock and wildlife health. A summary of data from the program is provided in Table 3-4 above.

Although reports of human illness associated with feral swine are rare, this may be due to misdiagnosis (Amass 1998). The CDC reported two incidents of individuals contracting *Brucella suis* from feral swine that were initially diagnosed by medical professionals as other illnesses (CDC 2009). There are likely illnesses contracted from swine that people may perceive as the common flu or other more common illnesses that are left untreated, unreported, or misdiagnosed (Hutton et al. 2006). Additionally, feral swine are often not the only possible route of transmission for some of these diseases and attributing the source of more common infections to a specific source is often challenging. In addition to the rare instances of direct disease transmission to humans, secondary infections through a third host can occur. Feral swine may transmit many diseases to other wild mammals, birds, and reptiles which in turn may transmit them to either domestic livestock or humans (Hutton et al. 2006).

Water contamination caused by feral swine can also pose a risk to human health and safety. In some areas, such as Plum Creek in Texas, water quality degradation by feral swine is so severe that the water body cannot support contact recreation. Feral swine can also contribute to protozoal contamination of drinking water supplies, potentially increasing water treatment costs. Atwill et al. (1997) found that feral swine in western California shed the intestinal parasites *Cryptosporidium parvum* and *Giardia* spp. when they defecate in and around the margins of water bodies. They reported that under appropriate environmental conditions, feral swine may contaminate surface water supplies with these protozoa leading to additional water treatment requirements by municipalities.

While serious diseases that pass from swine to humans may be rare in the U.S. due to modern livestock production, disease control, water treatment, and medical technology, diseases like brucellosis, anthrax, rabies, plague, tuberculosis, and tularemia can be fatal for the infected individual (Hutton et al. 2006). Following is a brief description of feral swine zoonotic diseases of significance.

<u>Brucellosis</u>

Brucellosis (*Brucella suis*) is a common infection of feral swine throughout the United States. With the recent expansion of feral swine populations across the country, this disease poses an increasing threat to agricultural producers and hunters (Leiser et al. 2013). Human infection by *Brucella* bacteria is possible and not uncommon. Due to the naturally occurring infection in feral swine, hunters are at increased risk of developing brucellosis from handling and dressing wild swine but cases are rare (Davidson and Nettles 1997). Health officials in Florida documented that 6 of 9 (8 confirmed and one probable) human cases of brucellosis in 2010) were linked to wild pig hunting activities (Florida Department of Health 2011). From 2001 through 2010, 82 cases of brucellosis were reported in Florida. In humans, the disease manifests itself with flu-like symptoms including intermittent fever, headaches, muscle and joint soreness, and weakness. Though few humans die of infection, the disease is often chronic and debilitating (West et al. 2009).

<u>Trichinosis</u>

Trichinosis is caused by a nematode, or round worm, parasite *Trichenella spiralis*. Infected feral swine and other animals rarely show definitive signs of infection. A variety of animals are susceptible to trichinosis, including feral swine, bears, wolves, wolverines, raccoons, foxes, rats, and birds. Hosts become infected by eating larvae in the muscle of infected animals. Adult worms live in the intestinal tract, and the larvae form cysts in muscle tissue. More larvae can be found in the most active muscles of the body, including the tongue, diaphragm, jaw, and intercostal muscles. The larvae remain viable for years within muscle tissue until ingested and passed on to the next animals. While trichinosis does not produce illness in feral swine and other infected animals, it is an important disease because of human infections that cause severe flu-like symptoms and potentially lead to death (Davidson and Nettle 1997, Davidson 2006). Large outbreaks of trichinosis have been attributed to consumption of contaminated feral swine meat (Barrett-Connor et al. 1976, Greenbloom et al. 1997, Serrano et al. 1989).

<u>Tuberculosis (TB)</u>

TB is a disease caused by a bacterium called *Mycobacterium tuberculosis*. *Mycobacterium tuberculosis*, is sub-classified into types based on the species of host usually affected: the human type generally referred to as *M. tuberculosis* affects people and primates, the bovine type , *M. bovis*, affects cattle, badgers, and other wild herbivores and sometimes people; the avian type, the *M. avian/M. intracellulare* complex, affects mainly birds. Pigs are susceptible to all three but are most commonly affected by *M. avian* (The Pig Site 2012*a*). The bacteria usually attack the lungs, but TB bacteria can attack any part of the body such as the kidney, spine, and brain. If not treated properly, TB can be fatal. TB was once the leading cause of death in the United States.

<u>Toxoplasmosis</u>

Toxoplasmosis is a disease caused by the protozoan *Toxoplasma gondii*, which affects animals and people. The life cycle is indirect. Cats are primary hosts and the only one that sheds infective oocysts in their feces. Pigs may become infected by ingesting feed or water contaminated with cat feces, by cannibalism of other infected dead pigs, by ear and tail biting or by eating infected rodents or other uncooked meat (The Pig Site 2012*b*). The primary dangers of toxoplasmosis to human health appears to be in immunosuppressed people because it can cause lethargy and lesions that may include vision loss, and to pregnant woman because it can cause miscarriage (Boden 2001).

<u>*Escherichia coli*</u>

*Escherichia coli* (*E. coli*) infections usually result from ingesting food contaminated by small amounts of infected human or animal feces, and may result in bloody diarrhea and other gastrointestinal symptoms. *E. coli* bacteria normally live in the intestines of people and animals (CDC 2012*a*). Most *E. coli* are harmless and actually are an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness. Some kinds of E. coli cause disease by making a toxin called Shiga toxin. The bacteria that make these toxins are called "Shiga toxin-producing" *E. coli*, or STEC for short. Some types of STEC frequently cause severe disease, including bloody diarrhea and hemolytic uremic syndrome (HUS), which is a type of kidney failure (CDC 2012*a*). The most commonly identified STEC in North America is *E. coli* O157:H7. Although other types of *E. coli* also produce shiga-toxins, currently, there are limited public health surveillance data on the occurrence of non-O157 STECs, and many STEC O145 infections may go undiagnosed or unreported (CDC 2012*a*). STEC live in the guts of ruminant animals, including cattle, goats, sheep, deer, and elk. The major source for human illnesses is cattle. STEC that cause human illness generally do not make animals sick. Other kinds of animals, including pigs and birds, sometimes pick up STEC from the environment and may spread it (CDC 2012*a*).

Recently, raw or minimally processed fresh produce (e.g., lettuce, spinach, unpasteurized juices, or raw sprouts) has emerged as an import food vehicle for the spread of *E. coli* (Jay and Wiscomb 2008). In September 2006, an outbreak of

E.coli O157 was linked to consumption of fresh, bagged baby spinach, with 26 states and Canada reporting 205 cases of illness and 3 deaths (Jay et al. 2007). The exact mechanism of in-field contamination of the plants is unknown, but potential environmental sources include contaminated fecal material (domestic livestock, wildlife, human), water, soil amendments (compost), or bioaerosols. However, findings of *E. coli* and campylobacter in feral swine feces in the area suggest that they may have contributed to the contamination of the plants (Jay and Wiscomb 2008). *E. coli* infections have been linked to feral swine in other regions. In Texas, 4 of 7 (57%) feral swine tested in one small area carried STEC which could be pathogenic to humans (Bodenchuk 2008).

<u>Leptospirosis</u>

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*. In humans, it can cause a wide range of symptoms, some of which may be mistaken for other diseases. Some infected persons, however, may have no symptoms at all. Without treatment, *Leptospirosis* can lead to kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, respiratory distress, and even death (CDC 2012*b*). The time between a person's exposure to a contaminated source and becoming sick is 2 days to 4 weeks. Illness usually begins abruptly with fever and other symptoms. Leptospirosis may occur in two phases. After the first phase (with fever, chills, headache, muscle aches, vomiting, or diarrhea) the patient may recover for a time but become ill again. If a second phase occurs, it is more severe; the person may have kidney or liver failure or meningitis; this phase is also called Weil's disease (CDC 2012*b*).

Many species have been implicated as reservoirs for the bacteria including squirrels, raccoons, opossums and feral swine. A recent study testing for antibodies to multiple forms of *Leptospira* in 158 male and 166 female feral hogs collected by hunters and permitted trappers in Florida determined that 33% of all samples were positive for at least one form of *Leptospira* and 46% of the positive samples tested positive for multiple forms of *Leptospira*. The authors concluded that feral swine likely play a larger role in the complex causes and ecology of the disease in Florida than previously believed and that additional research was warranted.

### *c. Aggressive or Habituated Feral Swine*

Feral swine are formidable and have sometimes attacked humans (MDC 2013). Generally, feral swine prefer to run and escape danger and incidents of swine attacks on humans are rare relative to the size of the feral swine population. Their razor sharp tusks combined with their speed can cause serious injury (TPW 2013). In the United States, four people have died from feral swine attacks since the late

1800s. Three of the four victims were attacked by a wounded boar while hunting (Extension 2012*a*).

Mayer (2013) reviewed media records and other reports of 412 wild pig attacks on humans which occurred worldwide over the period of 1825 to 2012 (70% occurred from 2000 to 2012). The majority of attacks were from the species native range, but 24% were from the United States, with the highest level of attacks in Texas, Florida, and South Carolina. Most attacks occurred in rural areas, although the number of attacks in urban/suburban areas has been increasing since the mid-1990s (Mayer 2013, Extension 2012*a*). Attacks primarily occurred during daylight hours and, although attacks occurred year-round, they were most common during the winter months. The majority of attacks (76%) occurred under non-hunting circumstances. The most common (41%) identifiable cause of the attacks was the animal being threatened. However, there were differences among hunting and non-hunting related attacks; with 48% of hunting related attacks associated with wounded animals and 49% of non-hunting related attacks apparently unprovoked. Most attacks involved a single animal (82%). Attacks involving multiple animals did occur and were more likely in urban/suburban areas. In cases where sounders were involved, generally only one or two individuals from the sounder were involved in the attack. The largest number of animals involved in physical contact/mauling was six.

The presence of dogs being walked by their owners has been suggested as a hazard with respect to instigating feral swine attacks. Feral swine may perceive dogs as predators and a potential threat (Mayer 2013). However, the review by Mayer (2013) found no clear trend on this issue. In some instances, pets helped to defend their owners from the feral swine, and in most instances the companion animal survived uninjured. Nonetheless, Mayer (2013) identified traveling in undeveloped areas with dogs as a potential high risk activity. Other at-risk activities identified by Mayer (2013) included traveling alone and on foot through undeveloped areas, especially areas with heavy vegetation; threatening or chasing feral swine (e.g., out of a yard or field); approaching an injured animal; approaching or attempting to feed/pet/touch feral swine, especially those in suburban/urban areas; and blocking the path of or cornering feral swine.

The most frequent outcome for victims is mauling, typically to the feet or legs, or no injury (Extension 2012*a*, Mayer 2013). Injuries are primarily lacerations and punctures, and can be extensive. Serious infections or toxemia can result from injuries (Extension 2012*a*, Mayer 2013). Feral swine have been observed foraging in parks and campgrounds. The increased level of human-swine interactions at these sites increases the risk that human behavior could inadvertently trigger a defensive response in swine. There are also concerns that swine in these areas may learn to associate humans with food and could aggressively solicit handouts in the same manner as has occurred with some wildlife species.

### *d. Feral Swine as a Food Source*

Feral swine meat is considered highly desirable by some people because of difference in flavor from domestic swine and because it is generally leaner than pen-raised pork (Taylor 2003). Feral swine also represent a semi-controllable source of meat (Bach and Conner 2013). Landowners and owners of agricultural operations may consume the meat, sell the live animals, or give them to willing and receptive individuals. Live hogs are often sold to interested individuals, who often butcher them for themselves (Bach and Conner 2013). In some areas, particularly those with long-established feral swine populations, feral swine may be a low-cost diet supplement.

Approximately 57 – 72% of live weight of a domestic pig is available for consumption after processing (Oklahoma Department of Agriculture, Food and Forestry undated, Sterle 2000). With average weights ranging from 75-250 pounds, an adult feral swine can make a substantial difference in a family's food budget. The extent to which feral swine are used as a supplemental food source, particularly by low income families has not been documented. Impacts and use may be greatest in areas where feral swine have been abundant and well established for years, particularly in Hawaii, the Territories, and southern portions of the United States. In Texas, between 2004 and 2009, approximately 461,000 feral hogs were federally inspected prior to slaughter at Texas processing plants (Higginbotham 2013). This figure does not include the pigs kept for home use. Use of swine is also likely to be greater in areas that have year-round seasons, no limit on take and where no additional permits are required to hunt swine. Cultural and traditional participation in hunting and use of swine will also impact the degree to which swine are used as supplemental food by low income families.

Consumption of feral swine involves risks that do not occur with domestic pork. As noted above, feral swine carry several diseases transmissible to humans. One disease of particular concern for hunters and others processing swine is swine brucellosis. Individuals processing feral swine are advised to wear long sleeves, eye protection and use disposable or plastic gloves when butchering and field dressing feral hogs. Hands should be washed thoroughly with soap and water for 20 seconds or more after handling feral swine. Clean all tools and reusable gloves with a disinfectant after field dressing or processing meat. Meat should be cooked to an internal temperature of 160 degrees. (CDC undated, 2012*c*)

Under the Federal Meat Inspection Act, all swine are required to be inspected prior to entering into any establishment in which they are to be slaughtered. Inspections are carried out under the USDA Food Safety and Inspection Service (FSIS). FSIS has ruled that all swine are subject to the Federal Meat Inspection Act and even if donated are considered to be in commerce; therefore all animals must be processed under inspection at an official establishment. This would entail examining the animal alive, at rest, and in motion from both sides before passing the animal for slaughter. Section 303.1 of the Act provides an exemption for individual landowners/managers who may slaughter swine for their personal use or use by family members, nonpaying guests, and employees. There is also an option for custom processing of meat at an approved facility, again, only so long as the meat will be used by the individual landowner, nonpaying guests and employees, and as long as the meat is not sold. The logistics and cost considerations associated with getting live swine to processing facilities that will accept feral swine will limit the donation of swine for human consumption.

### 2. Resources Which May Be Impacted by Feral Swine Damage Management on Human Health and Safety

#### *a. Cooperators and the Public*

The environmental impact of each of the alternatives on human health and safety is analyzed in detail in Chapter 4 Section C.7. Methods that might raise safety concerns include the use of firearms, aerial hunting, snares, pyrotechnics for hazing, traps, drugs used for animal handling and carcass disposal. Although not currently available for use, we also anticipate the need to address safety concerns associated with toxicants (e.g., sodium nitrite) and reproductive inhibitors when these products become available for use. Analyses in Chapter 4 Section C.7 indicate APHIS-WS use of shooting, aircraft, hazing with pyrotechnics, snares, traps, drugs for animal handling and carcass disposal poses little risk to the human environment. The choice of methods which may be used on the property of cooperators requesting assistance is established through a MOU, cooperative service agreement, work plans or similar documents. Potential risks, risk mitigation measures (if needed) and advantages of management methods are discussed with cooperators when developing the agreement for the site. When selecting methods to control feral swine damage, APHIS-WS' employees consider risks to human safety when employing those methods based on location and method. For example, risks to human safety from the use of methods would likely be lower on private lands in rural areas that are less densely populated. Activities would generally be conducted when human activity is minimal (e.g., early mornings, at night) or in areas where human activities were minimal (e.g., areas closed to the public).

Direct risks to the public from the use of snares, foothold traps, and live capture devices are unlikely, but there is the indirect risk of injury to individuals attempting to release a pet from the devices and if individuals approach within reach of captured swine. Use of firearms is also often a safety issue to the public because of concerns pertaining to misuse of firearms. Concerns may also exist that feral swine carcass disposal methods could adversely impact human health through disease transmission risk from carcasses left in the field, disease transmission risks associated with consumption of feral swine, or water contamination from swine carcasses. There is also a need to address potential risks to human health from residue of drugs used for animal handling to individuals who subsequently capture and eat the swine. Similar concerns will relate to the use of toxicants and reproductive inhibitors currently under consideration for eventual registration and use in FSDM. Compliance with laws and regulations for the protection of human health and safety and APHIS-WS SOPs reduce potential risks associated with proposed FSDM methods.

***b. Operators/Employees***

It is possible that APHIS-WS employees could be at an increased risk of exposure to zoonotic diseases carried and transmitted by feral swine during some FSDM activities. However, APHIS-WS' employees will adhere to the SOPs outlined in Chapter 2 Section G and are trained in the correct and safe use of personal protective equipment (PPE) to reduce or eliminate the potential for exposure to disease.

All APHIS-WS' personnel who handle and administer chemical methods are properly trained in the use of those methods. Training and adherence to agency directives (see Wildlife Services Directive 2.430) ensures the safety of employees applying chemical methods. Further, as discussed above in Section 2.a, in order to use firearms for damage management activities, APHIS-WS employees are required to attend firearms safety-training courses in accordance with APHIS-WS Directive 2.615 and to maintain such certification.

Aerial wildlife operations, like any other flying, may result in an accident. APHIS-WS' pilots and crewmembers would be trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The national Wildlife Services Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a Wildlife Services Flight Training Center and annual recurring training for all pilots. Still, accidents may occur and the risks to human safety from APHIS-WS use of aircraft and all other FSDM methods are addressed in Chapter 4 Section C.7.

***c. Feral Swine as a Food Source***

The Federal Meat Inspection Act requires that all swine be inspected pre- and post-mortem if they are to be sold or donated for human consumption. However, feral swine may be donated to the landowner/manager for their personal use. Consequently, some landowners with feral swine may see short-term increases in the feral swine available for food use. Depending upon State, Territorial, and Tribal regulations permitting hunting of swine and management goals for swine (e.g. sustainable population vs. eradication), reduction or elimination of feral swine populations could result in a long-term reduction in the amount of feral swine available for use as a low-cost source of food. Impacts and use may be greatest in areas where feral swine have been abundant and well established for years, particularly in Hawaii, the Territories, and southern portions of the United States.

## H. Regulatory Environment

This section discusses the regulatory environment which influences FSDM planning, compliance and efficacy. Besides providing environmental protections to resources that may be affected by FSDM actions, the regulatory environment also provides direction and places limitations on damage management planning and actions.

Numerous Federal, State, Territorial, and Tribal laws, regulations, and federal Executive Orders define the regulatory environment in which APHIS may conduct FSDM. Some Federal laws and regulations, such as the ESA or NEPA apply directly to APHIS actions wherever actions may occur. When APHIS enters into cooperative partnerships with other Federal, State, Territorial, and local agencies, Tribal governments, private landowners and others, additional Federal, State, Territorial, Tribal, and local laws may also be triggered that would influence damage management actions and outcomes. For example, actions on Federal lands must be conducted in compliance with applicable Federal laws that established the sites as well as agency and site-specific regulations, policies and management plans. Additionally, APHIS FSDM actions would continue to be conducted in accordance with applicable State, Territorial, Tribal and local laws and regulations. Additionally, laws, regulations and policies implemented by the APHIS-VS program impact swine management actions by State, Territorial, Tribal and local agencies and private entities. MOUs (Chapter 1 Section I) also define APHIS relationships with Agency Partners and Tribal governments.

### 1. Key Federal Laws

<u>National Environmental Policy Act (NEPA)</u>. NEPA requires that Federal actions be evaluated for environmental impacts and that these impacts be considered by the decision maker(s) prior to implementation. The Act also requires that agencies provide opportunities for public involvement in the environmental analysis process (e.g., creation of Environmental Assessments and Environmental Impact Statements). This EIS has been prepared in compliance with NEPA (42 USC Section 4231, et seq.,); the President's Council on Environmental Quality (CEQ) Regulations, (40 CFR Section 1500 – 1508), and USDA APHIS NEPA Implementing Regulations (7 CFR Part 372).

This EIS has been prepared to provide a programmatic evaluation of a nationally coordinated FSDM program. Emphasis has also been placed on as many local environmental values as was feasible for a program that is national in scope. Prior to completion of the NEPA process for this EIS, APHIS-WS developed state level or more local environmental assessments and issued Findings of No Significant Impact (FONSIs) on FSDM programs. Upon completion of this

Final EIS (FEIS) and issuance of the associated Record of Decision (ROD), the local EAs and FONSIs will be evaluated for conformance with the requirements of the ROD, and for consistency with the evaluations in the EIS. Local NEPA decisions on FSDM would be supplemented as necessary in accordance with CEQ and APHIS NEPA implementing regulations. Barring extraordinary local circumstances not evaluated in this EIS, some APHIS-WS programs in states with small or isolated feral swine populations may be able to conduct FSDM work under this EIS or such work may be categorically excluded according to APHIS NEPA Implementing Regulations (7 CFR Part 372).

Endangered Species Act (ESA). It is required under the ESA, that all Federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA (Sec.2(c)). Section 7 consultations with the FWS are conducted to use the expertise of the FWS to ensure that "*any action authorized, funded, or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species*". Numerous local level Section 7 consultations have been completed for Current FSDM Program (Alternative 1) activities. Based on the proposed/preferred alternative to implement a National FSDM Program, APHIS-WS has evaluated the potential for additional effects on T&E species from FSDM activities (Chapter 3, Section C.2 and Chapter 4, Sections C. 2 and C. 3). Rather than initiate a programmatic National ESA Section 7 consultation with this EIS process, APHIS-WS has determined that Regional, State Territorial, and local level Section 7 consultations would provide the best protection for T&E species, because they would allow for site specific analysis of local projects in local environments, and utilize regional, State Territorial and/or local FWS, NMFS, APHIS and partner agency/Tribal government biologists who are most familiar with the species and habitats where individual projects may occur.

Fish and Wildlife Act of 1956 (section 742j-1) Airborne Hunting. This Act was added to the Fish and Wildlife Act of 1956 and is commonly referred to as the Airborne Hunting Act or Shooting from Aircraft Act. The Act allows Federal and State agents or persons operating under a federal or State issued license or permit, to shoot animals from aircraft for certain reasons including protecting land, water, wildlife, livestock, domesticated animals, crops and human life. FWS regulates the Airborne Hunting Act but has given implementation to the States.

The Wilderness Act (WA). The WA established a national preservation system to protect areas "where the earth and its community life are untrammeled by man" for the United States. Wilderness areas are devoted to the public for recreational, scenic, scientific, educational, conservation, and historical use. The Act left management authority for fish and wildlife with the State for those species under their jurisdiction. Feral swine may be removed from wilderness areas with the techniques and strategies discussed in Chapter 2, provided that the proposed action is conducted in accordance with minimum tools analysis [Section 4(c)] and similar provisions implementing the Act. APHIS-WS coordinates all activities in WAs with the associated land managing agency (BLM, USFS, NPS, FWS) to ensure that any planned actions do not violate the WA.

Migratory Bird Treaty Act (MBTA). The Migratory Bird Treaty Act established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird. FWS released a final rule on November 1, 2013 identifying 1,026 birds on the List of Migratory Birds (FWS 2013). Species not protected by the Migratory Bird Treaty Act include nonnative species introduced to the United States or its territories by humans and native species that are not mentioned by the Canadian, Mexican, or Russian Conventions that were implemented to protect migratory birds (FWS 2013). Migratory birds would not be expected to be negatively affected by FSDM except in atypical circumstances involving a non-target capture or lead poisoning from scavenging on feral swine shot with lead ammunition. Any take on a migratory bird would be reported to the Service, Migratory Bird Management Office. Chapter 4, Section C.3 contains a detailed evaluation of the potential effects on birds protected under the MBTA.

Bald and Golden Eagle Protection Act (BGEPA). This law provides special protection for bald and golden eagles. Similar to the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) prohibits the take of bald or golden eagles unless permitted by the Department of the Interior. The term “take” in the Act is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” Disturb is defined as any activity that can result in injury to an eagle, or cause nest abandonment or decrease in productivity by impacting breeding, feeding, or sheltering behavior. A detailed evaluation of the potential effects on eagles is contained in Chapter 4, Section C. 3.

National Historic Preservation Act (NHPA). The NHPA requires federal agencies to: 1) evaluate the effects of any federal undertaking on historic properties; 2) consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources; and 3) consult with appropriate American Indian tribes or Native Hawaiians to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Operational FSDM typically is not considered an undertaking under the NHPA since actions involving major ground disturbance, physical destruction or damage to property, alterations of property, wildlife habitat, or landscapes, or the sale, lease, or transfer of ownership of any property are not proposed with the possible exception of burial of carcasses.

Various APHIS-WS State programs have consulted with the appropriate State Historic Preservation offices and determined that typical wildlife damage management activities are unlikely to have any adverse effects on cultural, archeological, or historic resources. However, some of the activities involved in the National FSDM Program have the potential to affect cultural resources, particularly when operational work may be done in or near cultural sites, such as when the need for action involves protecting cultural resources from feral swine damage. Examples may include working near archeological or sacred sites to remove feral swine that threaten damage to such sites. In these instances, APHIS-WS state programs would determine if their actions would trigger NHPA consultations and APHIS-WS State Directors would initiate consultations accordingly. Chapter 4, Section C. 10. describes such situations and protocol for coordination with the State Historic Preservation office, Advisory Council on Historic Preservation, and agencies, Tribes and others who manage cultural resources. In addition, through scoping and outreach to tribal governments and native peoples, APHIS has considered the effects of the proposal on concerns for traditional and cultural values. These issues are discussed in Chapter 3, Section F, and Chapter 4 under Section C.10. Additional issues may be identified as APHIS-WS State Directors invite federally recognized tribes to consult on issues they have with state and local FSDM proposals.

Native American Graves Protection and Repatriation Act (NAGPRA). NAGPRA requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. FSDM projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods integrated into any selected program as implemented by APHIS-WS or other cooperating agencies must be registered with and regulated by the EPA and used in compliance with labeling procedures and requirements. No chemical control methods are currently registered for use in FSDM. While this EIS discusses the potential development of FSDM toxicants and provides some preliminary discussion, none are included in the proposed action for adoption and use in this EIS, therefore FIFRA applies only to the development and registration phases.

Federal Meat Inspection Act (FMIA). FMIA applies to all meat or products obtained from any cattle, sheep, swine, goat, horse, mule, or other equines intended for distribution in commerce. Feral swine are considered amenable species and sale or donation of the feral swine must be done in accordance with the FMIA. Animals falling under jurisdiction of the FMIA must be inspected pre- and post-mortem. Animals that are killed before they reach a slaughter facility are classified as "adulterated meat", and cannot be used for human food per the FMIA. As feral swine fall under authority of the FMIA, they could only be donated to charitable organizations for use as food by needy individuals if they are delivered alive to a USDA approved feral swine slaughter facility. Title 21 chapter 12, subchapter 1, section 623 of the FMIA provides an exemption for persons having animals of their own raising and game animals slaughtered for their own use without inspection. This provision allows landowners to utilize feral swine removed from their own property, with the understanding that meat derived from these feral swine will be consumed only by the farmer, his/her immediate family and/or nonpaying guests.

Coastal Zone Management Act (CZMA). This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to Federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for Federal approval, each state's plan is required to define boundaries of the coastal zone, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that Federal actions be conducted in a manner consistent with the federally-approved plan. The standard for determining consistency varies, depending on whether the Federal action involves a permit, license, financial assistance, or a federally authorized activity.

Federal Food, Drug, and Cosmetic Act. This law places administration of pharmaceutical drugs, including those which could be used in capture and handling of feral swine, under the Food and Drug Administration. Use of capture and handling drugs in FSDM is anticipated to be uncommon and primarily used in the context of handling swine for research or attachment of transmitters used to track feral swine used as Judas swine for damage management. This act regulates safe levels of pesticides in food and could apply to FSDM relative to the development of any toxicants or reproductive inhibitors for use in feral swine, and feral swine repellents intended for use on food crops.

Controlled Substances Act. This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that could be used in capture and handling of feral swine.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA). The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those which could be used to capture and handle feral swine. Those requirements are: 1) a valid "veterinarian-client-patient" relationship; 2) well defined record keeping; 3) a withdrawal period for animals that have been administered drugs; and 4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs by APHIS-WS. Veterinary authorities in each state and Territory have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee (WWHC) of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC 2010). APHIS-WS establishes procedures in each state and Territory where it intends to administer drugs used in wildlife and feral animal capture and handling that must be approved by state veterinary authorities in order to comply with this law.

### 2. APHIS Regulations Regarding Transportation of Feral Swine

Restrictions on the Interstate Movement of Swine because of Brucellosis (9 CFR § 78.30). As noted in Chapter 1, Authorities, APHIS-VS has promulgated regulations in 9 CFR Part 78.30 to specifically address disease in swine, primarily through regulation of the interstate movement of swine. With certain restrictions, the regulations allow for the interstate movement of feral swine directly to slaughter if they do not come into physical contact with any domestic swine or other livestock, or otherwise, as "monitored-negative" (based on an official testing program) within the last 30-days and accompanied by an APHIS or State animal health official permit.

### 3. Executive Orders

Several Executive Orders have been issued. These are not legislative, but nonetheless are binding to federal agencies.

Invasive Species (Executive Order 13112). The Invasive Species Executive Order directs Federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Like other non-native species, feral swine have caused significant damages to environmental and economic resources, and threaten human health. Chapter 1, Need for Action, and Chapter 3, Affected Environment, discuss the wide variety of harm and threats created by the expansion of feral swine in the U.S. and Territories.

Executive Order (EO) 13112 also established National Invasive Species Council (NISC) to ensure that Federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient. NISC is co-chaired by the Secretaries of the Interior, Agriculture, and Commerce. Other NISC members include the Secretaries of State, Defense, Homeland Security, Treasury, Transportation, Health and Human Services, the U.S. Trade Representative (USTR), as well as the Administrators of the EPA, National Aeronautics and Space Administration, and U.S. Agency for International Development. NISC provides high-level interdepartmental coordination of Federal invasive species actions and works with other Federal and non-Federal groups to address invasive species issues at both the regional and national levels, including assisting as a cooperating agency in the preparation of this DEIS.

NISC has developed and maintains a national invasive species management plan as required in EO 13112 (NISC 2001, 2008). The plan recommends specific objectives and measures for carrying out each of the Federal agency duties established in the Order and steps to be taken by NISC to carry out its assigned duties. The Management Plan includes a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and identifies research needs and recommends measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. The Management Plan identifies the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures must either take the action recommended or provide the Council with an explanation of why the action is not feasible. The Council assesses the effectiveness of the order no less than once each 5 years after the order was issued (NISC 2005) and reports to the Office of Management and Budget on whether the order should be revised. Management proposals and strategies in the feral swine DEIS are consistent with the provisions and recommendations of the National Invasive Species Management Plans (NISC 2001 and 2008).

Consultation and Coordination with Indian Tribal Governments (EO 13175). This EO directs federal agencies to provide federally recognized Tribes the opportunity for government-to-government consultation and coordination in policy development and program activities that may have direct and substantial effects on their Tribe. Its purpose is to ensure that tribal perspectives on the social, cultural, economic, and ecological aspects of agriculture, as well as tribal food and natural-resource priorities and goals, are heard and fully considered in the decision-making processes of all parts of the Federal Government.

APHIS recognizes the rights of sovereign tribal nations and the importance of strong partnerships with Native American communities across the country. A unique legal relationship exists between each Tribe and the Federal Government. APHIS is committed to respecting tribal heritage and cultural values when planning and initiating FSDM programs. APHIS offers early opportunities for formal government-to-government consultation to all Tribes. In this way, Tribal governments may cooperate in program planning and/or raise issues of concern that can be incorporated into the planning and decision making process. APHIS-WS has invited all federally recognized Tribes to enter into formal consultation on the proposed National FSDM Program. In addition, potentially affected Tribes have been, and will continue to be invited to consult on local level FSDM planning. APHIS primarily uses the NEPA planning process to guide government-to-government consultation and to facilitate cooperation and partnerships with Tribes. Some Tribes have either chosen formal consultation and cooperation, and some have decided to participate on a less formal level by raising issues or concerns for analysis. Tribal outreach associated with early planning for this EIS was discussed in Chapter 1, Section I. Tribal concerns and values raised during the Tribal outreach process are discussed in Chapter 3, Section F.2. FSDM effects on Tribal values are also evaluated in Chapter 4, Section C.10.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898). EO 12898 promotes the fair treatment of people of all races, income and culture with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment implies that no person or group of people should endure a disproportionate share of the negative environmental impacts resulting either directly or indirectly from the activities conducted to execute this country's domestic and foreign policies or programs. Through the NEPA process, as identified and discussed in Chapter 3, Section F and Chapter 4, Section C.7, APHIS has evaluated its activities for compliance with Executive Order 12898 to ensure that the activities would not result in any adverse or disproportionate environmental impacts to minority or low-income persons or populations.

Facilitation of Hunting Heritage and Wildlife Conservation (Executive Order 13443). This order directs Federal agencies that have activities that have a measurable effect on outdoor recreation and wildlife management, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. It directs federal agencies to cooperate with states to conserve hunting opportunities. APHIS-WS cooperates with state wildlife and other resource management agencies in compliance with applicable state laws governing feral swine management. State, Territorial and Tribal agencies, not APHIS, have the authority to determine whether or not feral swine are managed as a game species, hunted, eradicated, contained, or managed for local damages. FSDM effects on opportunities for feral swine hunting and on opportunities for hunting other species affected by feral swine is discussed in Chapter 4, Section C.5. Conversely, FSDM management actions may be initiated to protect and preserve native wildlife species and associated hunting opportunities.

Protection of Children from Environmental Health and Safety Risks (EO13045). Children may suffer disproportionately from environmental health and safety risks for many reasons. SOPs designed to protect human health and safety from FSDM operations are discussed in Chapter 2, Section E, and effects on the safety and health of children is discussed in Chapter 4 under Section C.7.

### 4. State, Territorial, Tribal, and Local Laws

It is APHIS-WS policy to comply with applicable State and local laws and regulations that do not directly and substantively conflict with its Federal statutory authorities (APHIS-WS Directive 2.210). This is due to the cooperative nature of the program and the non-regulatory status of the APHIS-WS program. Various state laws influence FSDM activities. State laws may be directly related to FSDM, or indirectly through regulation of various component actions. These may include laws for protecting State, Territory or Tribe-listed endangered species, laws imposing restrictions on the use of capture or removal methods, or laws dictating carcass disposal options. APHIS-WS conformance with state and local laws generally helps to minimize negative environmental impacts and allows the flexibility to honors states' legislative decision making. In some states, the "mini NEPA" requirements (State laws similar to the federal NEPA) are triggered by partnerships with local and state agencies. States often choose to comply with "mini NEPA" laws by cooperating in the development of joint NEPA/state environmental documents. Because of the variety and range of State, Territorial, Tribal, and local laws, they will not all be addressed in detail in this EIS. APHIS-WS considers applicable State, Territory, Tribal, and local laws and regulations in local NEPA decision making. On most public lands and on other federal properties, and some Tribal lands, MOUs that describe the roles, authorities, and legal responsibilities for FSDM are either in place or would be completed to facilitate FSDM program implementation.

During program and project planning, formal agreements are formed which outline the legal responsibilities of each agency involved. State and Territorial agencies generally manage feral swine, whether as an invasive pest, a game animal or some intermediate designation. Therefore, APHIS-WS follows State and Territorial regulations governing feral swine. In addition, when on Federal, State, local, or private lands, APHIS follows state regulatory restrictions on FSDM methods (e.g., aerial and ground shooting or restrictions on the use of traps and snares). On NPS lands, NPS has the authority to manage feral swine. Other Federal land management agencies may coordinate with State and Territorial agencies within the constraints of agency mission and management direction established for the property in question. However, State or Territory status as a game species would not preclude Federal land managers from seeking to reduce or eliminate feral swine populations on their property in accordance with agency policy on management of non-native, invasive species and EO 13112.

When FSDM work is requested by federally recognized tribal governments, tribal law would be followed as indicated in agreements made with Tribes. APHIS-WS also complies with Federal laws on Tribal lands. Because Tribes are sovereign governments, State laws may not apply. APHIS-WS will also coordinate with Tribes in situations where tribes have retained rights to hunt fish and gather on lands not currently included in tribal reservations or other tribal properties (e.g., ceded territories).

The State laws with the greatest influence on the planning and overall outcome of the operational APHIS FSDM programs would be those directly governing feral swine management including feral swine game management, hunting, and transportation. Part of the National FSDM Program would include work with State, Territory, and Tribal entities to aid the development of laws and regulations which facilitate management of feral swine damage and reduce the risk of introduction and/or spread of feral swine populations. Information on State and Territorial feral swine management laws are provided in Appendix D Tables 1-3. Major highlights are summarized below.

<u>Feral Swine Game Management and Hunting Laws</u>. California, Hawaii, Florida, Alabama, and Guam manage feral swine as a game mammal. In addition, most states allow hunting of feral swine for control purposes (Appendix D Table 3). State laws vary with respect to restrictions on hunting such as licensing requirements, where feral swine may be taken, and whether or not there are hunting seasons. Approximately half of all States allow private landowners to sell hunting opportunities for free-ranging swine on their lands. Most of these states allow private fenced hunting preserves. State hunting laws are important to the analysis of impacts because hunting and selling hunts may increase incentives to maintain populations of feral swine and/or create the unintended impression that relocation of swine to create local hunting opportunities is acceptable (Bevins et al. 2014). This may affect the efficacy of eradication or control programs and may contribute to the damages inflicted by feral swine. In States, Territories and

Tribes that manage feral swine as a game species, or allow hunting or selling of hunts, hunters and related businesses may be negatively affected by FSDM.

Feral Swine Transportation. In addition to the federal regulations governing interstate movements of feral swine, most states have regulations in place that further restrict interstate movement of feral swine, and some regulate intrastate movements. Some States have indicated that enforcing the regulations is difficult. This is an important consideration that may contribute to the spread of feral swine and could challenge a control or eradication program. A listing of the State regulations with bearing on transportation is contained in Appendix D Table 1 (plus APHIS Regulations in Section 2 above).

# Chapter 4: Environmental Consequences

## A. Introduction

Chapter 4 contains the evaluation of the potential environmental consequences, or effects of FSDM. The environmental issues identified and described in detail in Chapter 3, Affected Environment, are discussed for each of the alternatives identified in Chapter 2, Alternatives. The direct, indirect, and cumulative effects are identified where applicable.

Significance Criteria

The CEQ regulations on implementation of the NEPA (40 CFR 1500-1508) describe the elements that determine whether or not an impact is "significant." Significance is dependent upon the context and intensity of the impact. The following factors will be used to evaluate the significance of impacts in this EIS as they relate to the context and intensity of biological and other ecological effects. Social and economic impacts will be evaluated similarly to the extent applicable.

- **Magnitude of the Impact.** Magnitude relates to the size, number, or relative amount of the impact. It is a measure of intensity. Magnitude as it relates to biological impacts is a measure of the number of individual animals or species removed in relation to their abundance. Quantitative analysis is used wherever possible because it is more precise, rigorous, and based on the best available population estimates. Qualitative analysis is based on population trends and modeling. Magnitude may be determined either quantitatively or qualitatively.

- **Duration and Frequency of the Impact.** The duration and frequency may be temporary, seasonal, year round or ongoing. Duration and frequency is a measure of intensity.

- **Likelihood of the Impact.** The likelihood of an impact is a measure of its intensity by estimating the possibility that an activity or impact may occur.

- **Geographic Extent**. The consideration of the geographic extent of an effect may be site specific, within a given management area, at the state/territory/tribal land area, regional and/or national. The geographic extent of an effect is a contextual consideration.

- **Legal Status.** The legal status of an affected resource is a contextual consideration. Legal status may range from fully protected by law, such as an endangered species, to not protected by law, as is the case for feral swine in some states where feral swine eradication is the management objective.

- **Conformance with Statutes, Regulations and Policies.** Statues, regulations, and policies provide contextual information in the analysis. Compliance with applicable statutes, regulations, and policies can also serve as mitigation to ensure that certain types of adverse impacts on the environment do not occur.

## B. Ability of Alternatives to Achieve Management Goals and Objectives

The overall purpose of the environmental analysis is to reduce feral swine damage to agriculture, natural resources, human health and safety, and property. Eight objectives were outlined in Chapter 1, Section G to measure progress towards the purpose. Five alternatives were created and evaluated against the objectives. This section reviews each alternative to determine if the alternative could be successful in meeting the objectives. The evaluation is distinct from the environmental impacts analyses in Chapter 4, Sections C through H, and will aid the decision maker in making a well informed decision that considers both the ability of the alternatives to meet the management objectives, and the environmental consequences of the FSDM alternatives.

### 1. Expand feral swine management programs nationwide to reduce the feral swine populations and associated threats to agriculture, natural resources, property, animal health, and human health.

For purposes of this analysis, APHIS will consider the total area and number of states with established feral swine populations as one of the primary measures of program efficacy and impacts on feral swine populations. Knowledge of the number of feral swine, present and the number of feral swine removed is important for effective local population management. However, we do not believe that consideration of the total number of swine removed by the program, the number of swine removed per unit time or cost per swine provide an accurate measure of national program efficacy. At low population densities, the resources and time required per animal to remove the last animals in a population can be substantial. An effective program which is close to achieving its goal of eradicating swine from an area is likely to have a lower rate of swine removal and higher cost per animal than projects in areas with high swine densities and areas in the early stages of project implementation. As discussed below, the impact of removing a set number of swine varies depending upon the initial feral swine populations. Removal of 100 or 1,000 swine from an area with a low or moderate feral swine population may reach the level of removal needed for population reduction, but would be inconsequential for statewide feral swine population reduction in areas like Texas and Florida with high feral swine populations.

Some States, Territories, and Tribes wish to retain a feral swine population while minimizing adverse impacts of feral swine on specific resources and populations. Even in areas where eradication is desired, it is likely to take many years to achieve population objectives in some areas. Consequently, efficacy of the program will also be assessed in terms of capacity to conduct local FSDM projects to protect agriculture, natural resources, property, animal health, and human health.

### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

The Current APHIS FSDM Program, the No Action Alternative, is a procedural NEPA requirement (40 CFR 1502) and serves as a baseline for comparison with the other alternatives. The No Action Alternative can be defined as "no change" from the status quo, which is the continuation of the Current APHIS FSDM Program activities. Using the Current APHIS FSDM Program (Alternative 1) as the No Action Alternative is consistent with the President's Council on Environmental Quality definition for No Action Alternative (CEQ 1981).

**Table 4-1.** Average annual number of feral swine removed by APHIS-WS during 2008-2012.

| State | Number of Swine Removed |
|---|---:|
| Alabama | 142.2 |
| Arkansas | 83.8 |
| Arizona | 31.2 |
| California | 863.2 |
| Colorado | 25.8 |
| Florida | 1,807.4 |
| Georgia | 321.4 |
| Hawaii | 744.8 |
| Iowa | 2.4 |
| Idaho | 0.4 |
| Illinois | 43 |
| Indiana | 1.8 |
| Kansas | 408 |
| Kentucky | 86 |
| Louisiana | 298.2 |
| Michigan | 126 |
| Missouri | 50.4 |
| Mississippi | 195.6 |
| North Carolina | 44.6 |
| North Dakota | 5.2 |
| Nebraska | 16.8 |
| New Hampshire | 6.8 |
| New Jersey | 3.2 |
| New Mexico | 116.2 |
| Nevada | 6.6 |
| New York | 16.6 |
| Ohio | 7.2 |
| Oklahoma | 3,310.2 |
| Oregon | 38.4 |
| Pennsylvania | 13 |
| South Carolina | 129.2 |
| Tennessee | 55.4 |
| Texas | 21,520.6 |
| Virgin Islands | 0.2 |
| Virginia | 2.4 |
| West Virginia | 5.6 |
| Wisconsin | 4 |
| **Total** | **30,533.8** |

<u>Impact on National Feral Swine Populations</u>

States, Territories, and Tribes have primary regulatory authority for feral swine. These entities set the management objectives for the area under their authority. Management objectives vary substantially (see, for example, Appendix D, Table 2) depending upon how long the species has been present, cultural and recreational uses of the species, and the extent of adverse impacts on and risks to agriculture and natural resources. APHIS understands and respects the authority of partner agencies, States, Territories, and Tribes to set their own management objectives for feral swine and regulate the methods which may be used for FSDM. Current APHIS FSDM projects are conducted in accordance with applicable, Federal, State, Territorial, Tribal, and local management objectives and regulations. APHIS-WS generally does not conduct FSDM in any area without the written consent of the landowner /manager, but in some very limited cases, APHIS-WS could remove swine from a property at the request of an agency with authority to order the removal[9].

To date, APHIS-WS' role in FSDM has included investigating reports of free-ranging swine and, if necessary, removing animals to prevent populations from becoming established, working with State agencies to eradicate swine in areas with limited feral swine populations, and responding to requests from landowners/mangers to address site-specific feral swine damage problems. APHIS-WS is able to use some of its general federal appropriations for FSDM, but in general, response to feral swine damage and reports of feral swine is dependent upon the availability of funding from cooperating agencies and landowners/managers (Section 4.C. Economics). On average, APHIS-WS has removed approximately 30,500 feral swine per year over the period of FY08-FY12 (Table 4-1).

APHIS-WS is not the only entity removing feral swine. Feral swine are also removed by State, Territorial, and Tribal agencies, Federal land management agencies, private landowners, recreational hunters, and damage management contractors. Assessing the cumulative impact of swine removals on feral swine populations is complicated by the general lack of information on the size of feral swine populations at the national or State/Territory level (Chapter 3, Section A.2). Only a few states and territories have a systematic method for estimating their feral swine populations. In the 2012 Annual State Summary Report of the Southeastern Association of Fish and Wildlife Agencies Wild Hog Working Group, only six of the 15 member states were able to provide a general estimate of the feral swine population in their state (Florida, Louisiana, Missouri, Oklahoma, Texas and Virginia). In most of these states, the estimate was based on anecdotal accounts, harvest surveys, and extrapolation from local studies, not a formal system of population estimation. Similarly, in an informal questionnaire sent to APHIS-WS State programs and their cooperators, only 15 of the 38 States or Territories with feral swine populations provided an estimate of their feral swine population (Appendix D, Table 2). The remaining 23 states with feral swine reported having an unknown population. An additional six reported sporadic occurrences. Ten states and territories reported having no feral swine. Since not all States and Territories track and/or report feral swine population data this document has to rely on the best scientific and commercial data available, which is presented in Table 3-2 and Appendix D.

In general, States and Territories have better knowledge of the distribution of feral swine in their area than the population size (Appendix D, Table 2). However, even this information is subject to differing interpretations as to what constitutes a

[9] In very rare circumstances, a regulatory agency may require the removal of feral swine from a property to address disease risks and may request the assistance of APHIS-WS in removing the animals. In these situations, APHIS-WS may work under the authority of the requesting regulatory agency.

feral swine population. Some agencies and authors consider any detection of free-ranging swine to be a "population." Others only consider an area to have a feral swine population if reproduction is documented in the area. The Southeastern Cooperative Wildlife Disease Study (SCWDS) started producing nationwide feral swine distribution maps in 1982. Populations are only considered established and recorded on the maps if the population has been present for 2 or more years or there is evidence of reproduction. Data for the maps is provided to APHIS-WS, State and Territorial natural resource and agriculture agencies, and other State and Federal agencies involved in natural resources management.

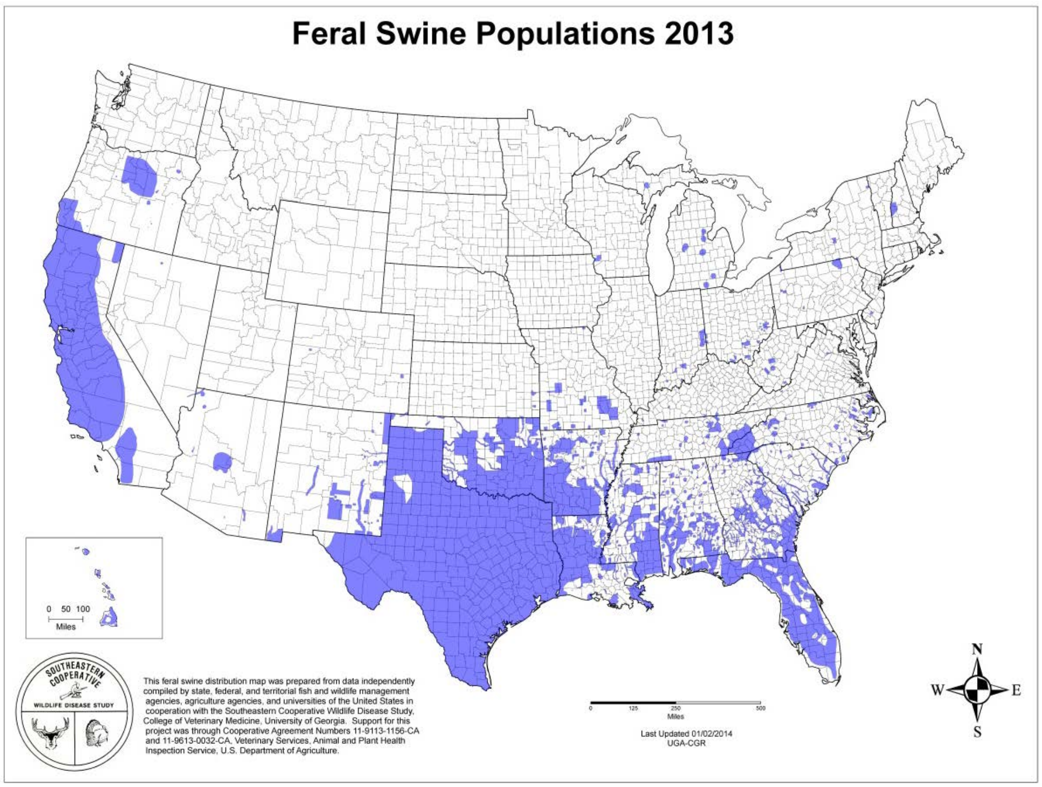


**Figure 4-1.** Feral swine distribution in the United States. Populations are only recorded as present for two or more years or there is evidence of reproduction (National Feral Swine Mapping System (http://swine.vet.uga.edu/nfsms/)).

Review of the SCWDS data from the period of 1982 to 2013 indicates that the cumulative impact of all feral swine removals to date have not reduced the overall area impacted by established feral swine populations since SCWDS started recording data in 1982 (Table 2-1). However, one state (Nebraska) has been able to eliminate an established feral swine population. Success in preventing populations from becoming established would not be reflected in the SCWDS data. Based on reports of sporadic detections of swine but no established feral swine populations (Appendix D Table 2), some States have had success in rapidly responding to and eradicating recently escaped/released swine before breeding populations became established.

**Table 4-2.** States with established feral swine populations and area occupied by feral swine from the Southeastern Cooperative Wildlife Disease Study. (J. L. Corn, SCWDS, pers. comm.).

| Year | Number of States with Feral Swine | Area with Feral Swine |
|---|---|---|
| 1982 | 17 | 210,443 sq. mi. |
| 2004 | 28 | 458,986 sq. mi. |
| 2011 | 37 | 492,770 sq. mi. |
| 2013 | 36 | 613,738 sq. mi. |

Although there has been little statewide or national success in reducing established feral swine populations, local population eradications can and have occurred. However, these efforts have generally involved island populations (Cruz et al. 2005, Miller and Mullette 1985) and/or used fencing to partition areas to be cleared of swine into smaller more manageable sections and prevent immigration of new animals (Schuyler et al. 2002). For example, feral swine populations have been successfully eradicated from Santa Cruz Island (Parkes et al. 2010) and Pinacles National Monument in California (McCann and Garcelon 2008). Feral swine in the surrounding area are excluded from Pinacles National Monument by approximately 24 miles of pig-proof fence enclosing over 14,000 acres. In 2012, the Southeast Association of Fish and Wildlife Agencies Wild Hog Working Group prepared a summary report containing information from 15 member states with feral swine (SEAFWA 2012). When asked about the efficacy of current management efforts, Texas, West Virginia, and Louisiana reported that current efforts were not successful in containing or reducing the population. Oklahoma reported that although some wildlife management areas were temporarily cleared of swine, the number of affected areas and total swine population continued to increase. Eight states reported local successes, but several noted that success was short term and ongoing effort was needed to keep new animals from moving into protected sites. One State did not provide a response and two States only provided statements regarding the efficacy of individual methods for site specific damage management.

The reproductive capacity of feral swine makes controlling feral swine populations particularly challenging. Timmons et al. (2012) used feral swine population demographics data from studies in the southern United States and information on feral hog habitats and harvest in Texas to estimate the impact of varying levels of harvest on the feral swine population. Based on their calculations, approximately 66% of the population would have to be taken on a long-term basis (at least five years) to stabilize the feral swine population in Texas. With an estimate of 1.8 to 3.4 million swine in the State, approximately 1.2 to 2.2 million feral swine would have to be removed each year to stabilize the population, a level of removal well in excess of the estimate of 750,000 hogs removed per year (Tompkins 2013). Other models have predicted that ongoing removals of 70% or more would be needed to reduce feral swine populations and that populations would rapidly rebound if control is interrupted (Mayer 2009d).

The logistical difficulties inherent in removing swine at a level sufficient to eliminate or reduce large or even moderate feral swine populations make it essential for agencies to respond promptly and effectively to detection of feral swine. It is also essential for agencies to commit to ongoing efforts until eradication is achieved (Mayer 2009d). In some cases, delaying or postponing control activities, even if only for a period of several months, can result in substantial increases in local populations and associated management costs (Mayer 2009d). Under current conditions, land managers and agencies may not be able to respond promptly to reports of feral swine due to resource limitations. Competing high priority needs for available funds may result in agencies delaying response until they start receiving numerous complaints of substantial damage. Unfortunately, by that time, difficulty and cost of control is likely to be high and probability of success is reduced.

Compensatory population responses are changes in population factors such as reproduction rates, immigration and survival of remaining animals that occur in response to reductions in animal populations. Reproduction in feral swine is linked to food availability (Geisser and Reyer 2005, Melis et al. 2006) and the availability of supplemental feeds such as crops and livestock feed can increase the density of feral swine in an area (Groot Bruinderink et al. 1994). Increases in reproduction commonly result from improvements in the amount of food available per animal when the population is decreased and associated improvements in body condition of remaining animals. Survivorship can also be impacted by food availability, particularly in areas with high seasonal variation in the availability of resources. Compensatory factors may reduce the efficacy of feral swine removal efforts (Hanson 2009, Mayer 2009*d*). However, the role of compensatory factors on feral swine population dynamics may vary depending on initial habitat quality and the level of feral swine removal. In areas of high quality habitat and in situations where removal efforts do not affect a sufficient proportion of the population to impact resource availability, compensatory factors may not influence feral swine population dynamics (Ditchkoff et al. 2012).

<u>Efficacy of Damage Management Methods</u>

Effective site-specific damage management programs can and are being implemented across the country and numerous descriptions of effective programs can be found in the scientific literature (Engeman et al. 2004, Campbell and Long 2009, Mayer and Brisbin 2009, West et al. 2009). Differences in habitat types, land use, presence of non-target species and other factors must be considered when developing effective and environmentally responsible FSDM programs.

Variation among sites means that no one FSDM method will be suitable for all situations. In addition to site variations, the ability of feral swine to learn to avoid capture devices or ignore (habituate to) frightening devices can limit the utility of some methods over time. The utility of specific damage management methods may also vary depending upon the size of the feral swine population. Consequently, effective FSDM programs require the integrated use of multiple methods either sequentially or concurrently to achieve the best results.

Other Factors Influencing Efficacy of FSDM Programs

Feral swine population dynamics and efficacy of damage management methods are not the only factors impacting the efficacy of FSDM programs. In a 2013 informal questionnaire completed by APHIS-WS state programs and their cooperators, funding and inadequate or contradictory regulatory mechanisms were the two most commonly cited challenges for States and Territories seeking to manage feral swine damage and/or eradicate feral swine populations (Table 4-3).

**Table 4-3.** Primary challenges to achieving State or Territorial feral swine management objectives. Data from informal survey of APHIS-WS state programs and their cooperators (APHIS-WS unpublished Data 2013).

| Primary Challenges Limiting Success of Feral Swine Damage Management Programs | Number of States and Territories Reporting the Challenge[1] |
|---|---|
| Funding | 31 |
| Inadequate or contradictory regulations | 14 |
| Increased interest in hunting and/or resistance from hunting interests | 5 |
| Difficulty in enforcing laws, especially laws pertaining to movement of swine | 4 |
| Need improved partnerships for feral swine damage management | 3 |
| Lack of public understanding of adverse consequences of feral swine | 3 |
| Private land ownership, land use, and property access | 3 |
| Lack of formal management objectives | 2 |
| Efforts started too late to be effective | 2 |
| Difficulties in balancing cultural and hunting uses while also managing damage | 1 |
| Issues with bordering states or countries | 1 |
| Illegal movement of swine | 1 |
| Difficulties in locating swine | 1 |

[1] Several States and Territories listed more than one issue.

### *b. Alternative 2: National FSDM Program (Preferred Alternative)*

This alternative provides funding for a nationally coordinated population control effort and improved capacity for site-specific damage management. APHIS would work to develop cooperative partnerships with agencies, Tribes, private organizations and individuals to optimize allocation of available FSDM resources through cost share projects and collaborative work toward common goals. Often, the APHIS' lead for these projects would be APHIS-WS State Directors. Collaboration with Canada and Mexico on projects of mutual concern can aid understanding of feral swine concerns along borders and reduce movement of feral swine across borders

Impact on National Feral Swine Population

In States, Territories, and Tribal lands where feral swine are emerging or populations are low and eradication is a management objective (Figure 4-2), APHIS would cooperate with agency partners, Tribes, and private entities to implement strategies to eliminate the populations. Once feral swine are removed from states with low populations, resources dedicated for population removal would be shifted to other areas, leaving only a minimal baseline capacity in these states to ensure feral swine populations do not become re-established. Funds would be available to help states investigate and respond to reports of feral swine to help prevent swine from becoming established in new states and states where populations are eradicated.

The target for the national population reduction effort is to eliminate feral swine from two states within the first five years of the program and then continue to eliminate feral swine from additional states at an average rate of two states every three years. A long term objective is to eventually eliminate feral swine from most states where they have become established over the past couple decades and where the States or Territories have requested assistance with eradication (Figure 4-3). Feral swine populations would remain in States and Territories that desire to maintain populations for recreational, cultural use or other purposes and in some areas where high densities and other conditions preclude eradication of the population.

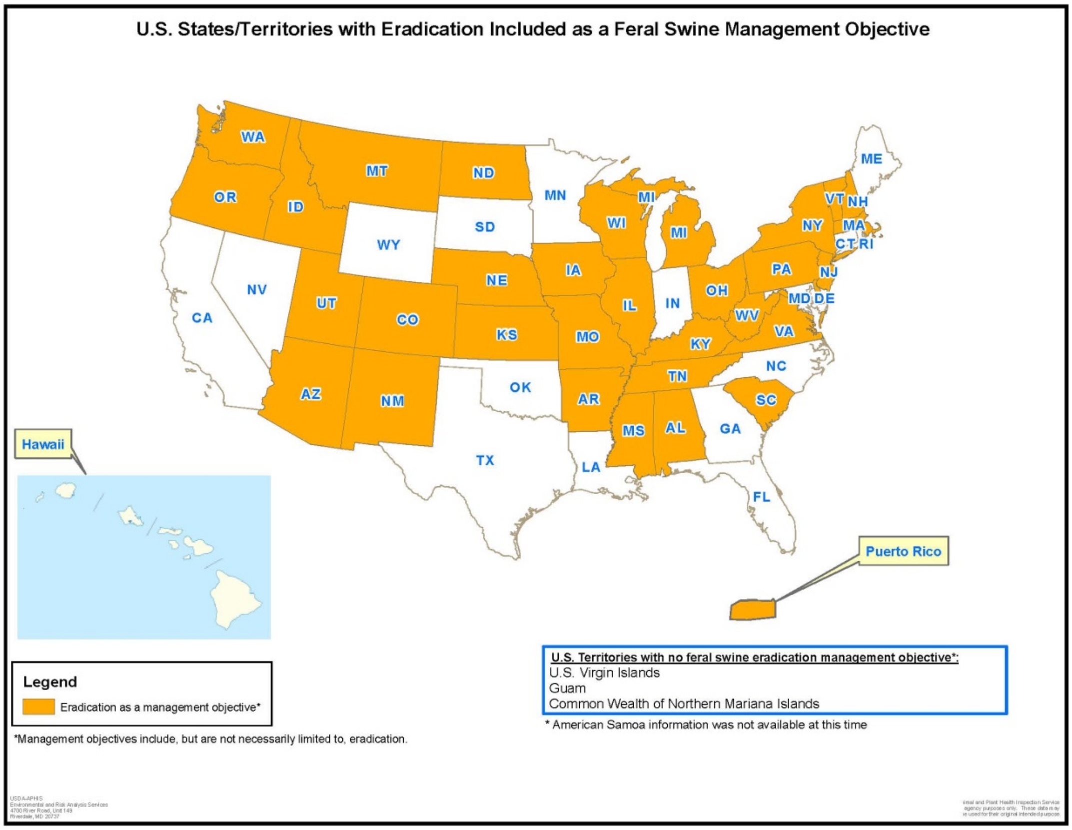


**Figure 4-2.** States and Territories with eradication or prevention as a management objective for feral swine. Data from an informal questionnaire sent to APHIS-WS State Directors and cooperating State and Territorial agriculture and natural resources agencies (Appendix D, Table 2).

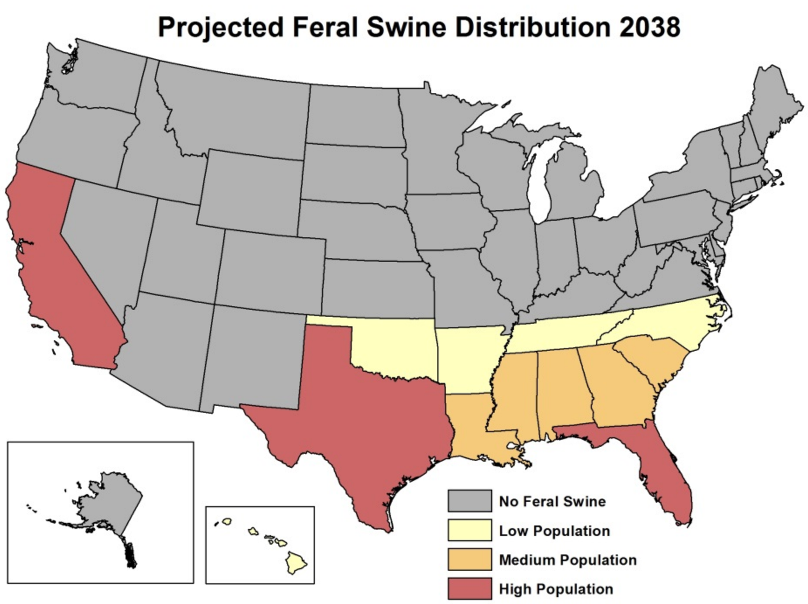


**Figure 4-3.** Objective range of feral swine in the year 2038 upon successful conclusion of FSDM program. Feral Swine populations are expected remain in Hawaii and the Territories.

Capacity for Local Damage Management

Baseline funds to enhance local damage management efforts would be made available to all APHIS-WS State programs serving areas with feral swine populations. In states with few feral swine, APHIS-WS would confirm reports of feral swine activity and remove them from local areas as appropriate in collaboration with state officials. By establishing some baseline capacity, APHIS-WS would be better positioned to remove swine from some areas while their populations are still relatively small. Establishment of baseline funding would enable APHIS-WS to improve the efficacy of current projects that are limited to areas where the cooperator can provide funding for management. This would improve the ability of the project to address overall populations and not just a patchwork of properties within populations. Cooperators typically have not requested APHIS-WS assistance until after feral swine populations are large or damage has become extensive. By establishing baseline capacity with appropriated funds, APHIS-WS can proactively address damage issues before they become significant. The level of baseline capacity established in each state would depend on current feral swine populations and distributions, current damage to resources, presence of potential resources likely to be damaged, and state or local regulations that impact management efforts. APHIS-WS would establish two helicopter teams in central locations to provide aerial support for operational programs.

APHIS-WS field employees would serve as the primary data collectors on feral swine populations. Each APHIS-WS State Director would track relevant information regarding the location, number, and impact of feral swine and report results to the Feral Swine Program Manager. These efforts would be supported by research to develop and refine population monitoring methods. Data would then be aggregated and summarized and then used to develop maps and other reports. These products would be used to track APHIS' progress in eliminating feral swine in particular locations, and in managing feral swine in other locations. The information would be valuable for tracking overall population trends, delineating feral swine free zones, and more efficiently tracking potential reintroductions of feral swine in areas where APHIS personnel have previously eliminated them.

The target for baseline projects is to establish APHIS baseline management capacity in all states[10] known or suspected to have established feral swine

[10] The actual number of states known or suspected to have feral swine population changes over time, and may have increased by the time this document is released for public comment. At the time this document was prepared, the list of target States for FSDM baseline capacity included Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina,

populations, and stabilize the increase in feral swine damage within 10 years of project initiation.

Additional funding for national and strategic local projects would also be available to APHIS-WS State programs to support national objectives on a smaller, more local scale. For example, projects designed to eliminate feral swine populations in specified areas (e.g., county level, refuges) within a state, enable collaborative opportunities to work with local stakeholders to address feral swine issues, or provide increased protection of local vulnerable resources (e.g., protect commercial swine facilities, or endangered or threatened species).

<u>Efficacy of damage management methods</u>

Under this alternative, additional funding would be available for research to develop new FSDM methods and improve the efficacy of existing methods. Although research is conducted under the Current FSDM program, the additional funding would substantially improve the scope and pace of projects which can be conducted concurrently. Priority areas for methods development include assessing the feasibility of using sodium nitrite to safely reduce feral swine populations. Research into reproductive inhibitors would also be facilitated under this alternative. Other key research areas include determining economic impacts of feral swine, and conducting research on swine-related diseases.

Research and disease monitoring conducted under this alternative would enable APHIS and cooperators to identify areas of greatest risk from feral swine and better target resources to areas of greatest need and maximum benefit. Improved information on the location and abundance of feral swine relative to sensitive resources and the economic costs and benefits of feral swine can be used by legislators, agency personnel, and the public to guide management decisions and the development of effective regulations and policies for feral swine management.

Targets for research efforts to improve methods include:

- Assessing feral swine toxicants and developing safe delivery systems;

- Adapting or developing a product to serve as a reproductive inhibitor in feral swine;

- Developing optimal surveillance/control strategies to be applied in two habitat types;

North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Texas, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin

- Developing or modifying, on average, one new removal technique annually;

- Creating maps depicting feral swine presence and protected resources within four years;

- Completing a risk analysis for a protected resource every two years;

- On average, completing an economic analysis or cost/benefit analysis every 2 years;

- Conducting at least one training workshop annually.

<u>Other Factors Influencing Efficacy of FSDM projects</u>

Federal funding provided under this alternative would help address some of the funding limitations listed by States and Territories as the primary impediment to achievement of FSDM objectives. APHIS-WS state programs would develop cooperative relationships and cost-share projects with agency partners, Tribes, and private entities to stretch the impact of the increased funding to improve the management efficiency and capacity of any one entity working alone on the issue.

Research and baseline capacity would increase the ability of APHIS programs to provide technical assistance and data for State, Territorial, Tribal, and local agencies and legislators who are developing regulations on feral swine. APHIS review of existing federal regulations may identify areas for improvement in existing regulations or potential new regulations which can facilitate effective FSDM.

Improved education and outreach efforts under this alternative would help agencies address problems with public understanding of the nature of the feral swine problem, the importance of prompt reporting of the presence of feral swine in areas where swine are not known to occur, and the costs and benefits of feral swine to their community. Outreach and education would be an essential tool in modifying perceptions of the acceptability of movement and release of feral swine. Movement and release of feral swine is one of the primary factors contributing to the rapid spread of feral swine in the contiguous United States.

The combination of research and outreach would improve the ability of landowners to identify and respond to feral swine damage on their property. Research may also be able to identify improvements in fencing and other practices to reduce the risk of swine escaping from domestic herds (i.e., pigs in pastures) and hunting facilities and the risk of disease transmission to captive swine.

APHIS would work with Canada and Mexico to develop a comprehensive border plan identifying regions with feral swine, estimating populations, and evaluating agriculture damage.

### *c. Alternative 3: Baseline FSDM Program*

This alternative focuses on improving the baseline FSDM capacity of all APHIS-WS state programs working in areas feral swine as described for the Integrated FSDM Program (Alternative 2). Allocations would be based on the size of the feral swine population in each state. This would maximize cost-share opportunities for operational management with agency partners, Tribes, and other cooperators.

Impact on National Feral Swine Population

Ability to achieve national feral swine population management objectives would be somewhat improved from the Current FSDM Program (Alternative 1), but substantially reduced from levels described for the Integrated FSDM Program (Alternative 2). All funding would be allocated to improve baseline capacity of APHIS-WS state programs. There would be no funding available to achieve national feral swine population containment and reduction objectives. The lack of allocated funds specifically for targeted population reductions is likely to slow or preclude eradication of feral swine from some states. Baseline funding, when combined with cooperator funds, may only be sufficient for eradication and/or substantial reductions in feral swine populations in states with low or moderate populations (Figures 2-2 and 4-2). The rate at which feral swine populations are eradicated, if it does occur, is likely to be lower than for the Integrated FSDM Program (Alternative 2) but slightly improved from the Current FSDM Program (Alternative 1).

Funding would not be held in reserve to investigate reports of feral swine in areas where swine do not currently occur and areas which have been cleared of swine. This may impede agency response to the occurrence of feral swine and increase the likelihood that feral swine populations may become established in new areas. The delay in response to reports in feral swine is also likely to increase the cost of response once the presence of swine is confirmed and management is eventually initiated.

Capacity for Local Damage Management

All funds would be allocated for baseline damage management capacity in states with feral swine populations. Individual APHIS-WS state programs would have the greatest amount of money to use to address local conflicts in cooperation with agency partners, Tribes, and private entities under this alternative. In the absence of coordinated national population reduction efforts, feral swine populations in some areas are likely to continue to increase. These increases and associated damage may eventually exceed the capacity of the expanded baseline damage management program. Overall efficacy of local projects would likely be reduced due to the lack of national funding for research, outreach and education, coordinated disease surveillance, damage and disease risk modeling and international coordination which would occur under the Integrated FSDM Alternative (Alternative 2).

Efficacy of damage management methods

There would be no increase in research, feral swine population or disease monitoring, and risk assessment under this alternative. Improvements to existing methods and development of new methods is likely to occur at a slower pace than under the Integrated FSDM Program and would likely be similar to the Current FSDM Program (Alternative 1).

Other Factors Influencing Efficacy of FSDM projects

This alternative would increase the baseline funding from Federal appropriations going to APHIS-WS state programs serving States, Territories, and Tribes with feral swine which would address one of the issues listed by states as an impediment to achievement of their FSDM management objectives listed in Table 4-3.

APHIS-WS state program staff would be available to respond to requests for assistance by providing technical or operational feral swine damage management to agricultural producers, agency officials, regulators and others as under the Integrated FSDM Program (Alternative 2). However, in the absence of the expanded research, disease surveillance, population monitoring, and regulatory review of the Integrated FSDM Program (Alternative 2), they would not have the same tools and information to assist cooperators. Research, outreach and education, international coordination and other benefits to the efficacy of the FSDM program resulting from national coordination and involvement in FSDM described in this section for the Integrated FSDM Program would not occur.

#### ***d. Alternative 4: National FSDM and Strategic Local Projects***

This alternative places emphasis on national FSDM projects and strategic local projects. No funding would be allocated to the augmentation of baseline capacity for all APHIS-WS state programs that support areas with feral swine. This alternative would focus all available resources on national and strategic local projects selected for their ability to help achieve national goals and objectives. APHIS-WS programs supporting States, Territories and Tribes with low or emerging populations and the desire to eradicate feral swine would be the initial project priorities, although strategic local funding could be allocated for projects in areas which are not identified as current priorities for swine eradication. Consequently, some APHIS-WS' programs in States, Territories and Tribes with large feral swine programs, or in areas where eradication is not feasible or desired (e.g., feral swine managed as a game species) may not receive any funding until such time as priority management objectives have been achieved and resources are shifted to other areas with feral swine. This alternative would maintain capacity to rapidly respond to reports of feral swine in States and Territories which do not have feral swine or feral swine are believed to have been eradicated.

Impact on National Feral Swine Population

Funding for working with States, Territories, and Tribes, to eradicate and reduce the national feral swine population as described for the Integrated FSDM Program (Alternative 2) would be increased under this alternative. The increase in funds may make it possible to achieve national feral swine population objectives more quickly than under the Integrated FSDM Program (Alternative 2).

Capacity for Local Damage Management

No baseline funding would be available under this alternative. Capacity for local damage management would be substantially reduced in some areas, particularly those which are not identified as priorities for national feral swine population control. Some limited funding for site-specific damage management would be available for national and strategic local projects as described for the Integrated FSDM Program.

Overall capacity for baseline FSDM would be similar to the Current FSDM program with some improvements in efficacy possible due to research, population monitoring, outreach and education, and international coordination which would have greater funding than under the Integrated FSDM Program (Alternative 2). However, the lack of baseline funding in some states may impede the ability of state programs to collect data for use in population and disease monitoring and mapping which may impede the quality or comprehensive nature of these projects unless research and monitoring funding is committed for this purpose.

Efficacy of damage management methods

Research, feral swine population and disease monitoring, and risk assessment would increase over current levels. Funding for these efforts would be greater than for the Integrated FSDM Program (Alternative 2), as would associated improvements in program efficacy. However, implementation of improvements and use of new information and outreach and education materials may be not be as effective in the absence of baseline FSDM capacity to assist all States, Territories, and Tribes with feral swine.

Other Factors Influencing Efficacy of FSDM projects

Funding for FSDM would be allocated to achieve national feral swine population management objectives and some national and strategic local projects. Consequently, APHIS-WS state programs serving some States, Territories, and Tribes would receive no increase in FSDM funding or less increase than under the Integrated FSDM Program (Alternative 2) or Baseline FSDM Program (Alternative 3).

Research, outreach and education, feral swine population and disease monitoring, and international coordination and associated benefits to program efficacy would occur at levels similar to or increased from the Integrated FSDM Program. However, in areas which are not identified as priorities for national feral swine population management, capacity to collect data for feral swine population and disease monitoring would likely be impaired as would capacity for technical assistance and implementation of improvements resulting from research.

***e. Alternative 5: Federal FSDM Grant Program***

Under this Alternative, APHIS would distribute funding to States, Territories, Tribes, organizations representing Native peoples, and research institutions. APHIS' role in operational FSDM would be substantially diminished and APHIS-WS would not conduct any FSDM under this alternative. Entities currently receiving APHIS-WS assistance with FSDM would be referred to the grant recipient conducting the FSDM work in their area. All feral swine control actions would be implemented by grant recipients or their agents.

Impact on National Feral Swine Population

Under this alternative, APHIS-WS state programs would not be involved in FSDM. All FSDM would be coordinated at the national level and conducted by States, Territories, Tribes and organizations representing Native Peoples with funds from grants issued by APHIS. Funds would be allocated to achieve the same national feral swine population management objectives as under the Integrated FSDM Program (Alternative 2). Agency partners, Tribes, and the public would not have access to the experience and equipment of APHIS-WS field staff and would have to find alternative sources for some materials and methods, particularly shooting from aircraft. Reductions in efficiency and increased administrative costs associated with this alternative would decrease the total funds available for project implementation. It would likely take longer to achieve target levels of national feral swine population reduction under this alternative.

Capacity for Local Damage Management

Baseline funds for FSDM and funds for national and strategic local projects would be available to all States, Territories, and Tribes with feral swine. However, APHIS-WS would not be involved in operational FSDM or provide technical assistance. These activities would be conducted by States, Territories, Tribes, and Native peoples with funds from grants issued by APHIS. APHIS-WS would not be able to be the grant recipient's "agent" under this alternative, restricting access to expertise and resources available through APHIS-WS. Increased administrative costs would reduce the funding available for management. APHIS would not be involved in the national collection and coordination of feral swine population or disease monitoring data, but these activities could theoretically be contracted out through the grants process.

Efficacy of damage management methods

Under this alternative, APHIS could issue grants to agencies, universities, Tribes and organizations representing Native Peoples to conduct research projects as under the Integrated FSDM Program (Alternative 2). Increased administrative costs would mean that less money is available for these activities than under the Integrated FSDM Program (Alternative 2). The NWRC would not be available to assist with product registration or development. The loss of NWRC resources and experience in this area would likely slow the development and registration of toxicants and reproductive inhibitors for FSDM.

Other Factors Influencing Efficacy of FSDM projects

Federal funding provided under this alternative would help address some of the funding limitations listed by States and Territories as the primary impediment to achievement of feral swine management objectives in a manner similar to the Integrated FSDM Program (Alternative 2). Some funding would be lost to increased administrative costs. However, some States, Territories, and Tribes and organizations representing Native Peoples may prefer receiving the money directly through the grant system to working with APHIS-WS state programs. However, one of the strengths of the APHIS-WS state programs is their ability to build effective working partnerships among agency partners, Tribes and private entities with common damage management interests. These skills would not be put to use under this alternative.

Research and data would be available for State, Territorial, Tribal, and local agencies and legislators who are developing regulations on feral swine as per the Integrated FSDM Program (Alternative 2). However, in the absence of a central point of contact for these projects, coordination of information may be diminished. Improved education and outreach efforts would occur under this alternative, but with less funding than under the Integrated FSDM Program (Alternative 2).

There would be no APHIS review of existing federal regulations to identify areas for improvement in existing regulations or potential new regulations which can facilitate effective feral swine management. APHIS would not be available to work with Canada and Mexico to develop a comprehensive border plan identifying regions with feral swine, estimating populations, and evaluating agriculture damage.

**2. Further develop cooperative partnerships with other pertinent Federal, State, territorial, tribal, and local agencies, and private organizations working to reduce impacts of feral swine.**

***a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)***

At present, most feral swine partnerships and relations are developed on the local scale as agencies, Tribes, organizations, and individuals respond to the challenges of managing feral swine in their area. As concerns regarding the impact of feral swine have increased, communities of practice have developed and are sponsored by states and research institutions to provide and exchange information on the impacts of feral swine and best practices for FSDM. Examples of these efforts include the websites sponsored by Texas AgriLife Extension (http://www.extension.org/feral_hogs), Mississippi State University (http://wildpiginfo.msstate.edu/), and the Internet Center for Wildlife Damage Management (http://icwdm.org/wildlife/FeralPigs.aspx). Agencies, universities, and other organizations also work collaboratively to sponsor conferences to facilitate communication and the exchange of information on FSDM. APHIS-WS state programs work individually with States, Territories, and Tribes to meet local management goals with only limited coordination with neighboring States and Tribes. State and some regional teams such as the Southeast Association of Fish and Wildlife Agencies Feral Swine Task Force exist to exchange information and work toward common goals for FSDM. However, there is no national coordination of efforts or national funding available to contain the spread of feral swine in the United States or reduce the current range and size of the feral swine population. However, some national coordination for disease monitoring has been possible under this alternative, although capacity for conducting monitoring has been limited (see Section B.3 below).

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

Under this alternative, resources would be available for national coordination of FSDM efforts. These efforts would include identification and allocation of resources to areas identified as national priorities to achieve a coordinated goal of reducing feral swine damage in the United States. APHIS would expand efforts to facilitate coordination of existing FSDM efforts among states and regions and establish new partnerships. APHIS would work to serve as a central point of contact for coordinating national and international FSDM projects.

#### *c. Alternative 3: Baseline FSDM Program*

This alternative focuses primarily on allocation of resources to APHIS-WS state programs to aid States, Territories and Tribes in addressing feral swine damage. Resources would be allocated to APHIS-WS state programs based on the size of local feral swine populations. No additional resources would be available to coordinate a national level response to feral swine damage. Coordination among states and tribes would be as described for the Current FSDM Program (Alternative 1).

#### *d. Alternative 4: National FSDM and Strategic Local Projects*

All available resources would be allocated for projects to achieve national priorities for FSDM and strategic local projects. Coordination of FSDM activities would be improved over current conditions and be similar to the Integrated FSDM Program (Alternative 2), with some possible increase in capacity over the Integrated FSDM Program, because funds that would be allocated for baseline FSDM would be allocated to national priority projects.

#### *e. Alternative 5: Federal Grant Program*

This alternative would provide resources to improve States, Tribal, and Territorial capacity for FSDM. Coordination of FSDM efforts and development of partnerships for FSDM would occur indirectly through the allocation of grants. Under this alternative, APHIS would not be directly involved in the implementation of FSDM projects. Loss of APHIS-WS state program involvement in the establishment of partnerships among agencies, Tribes, organizations, and individuals may adversely impact the development of effective partnerships to achieve national FSDM goals. Under this alternative, the role of APHIS in FSDM would shift from partner in conducting FSDM to supervisory authority. APHIS would be responsible for ensuring that grants are implemented in a manner consistent with project objectives and procedures established in this DEIS for the protection of the human environment, and that the projects meet other APHIS obligations including obligations to Tribes. This would be a fundamental shift in the nature of APHIS-WS existing partnerships with States, Territories, and Tribes.

## 3. Expand feral swine disease monitoring to protect agriculture and human health.

### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

APHIS-WS and VS programs have worked collaboratively to monitor for diseases in feral swine. Most samples collected by APHIS-WS personnel come from feral swine killed during damage management projects and swine killed by hunters. APHIS-WS submits samples to diagnostic labs identified by APHIS-VS to run diagnostic tests. Over 2,300 feral swine have been sampled during prior years to monitor for classical swine fever in the United States. These samples have also been used to monitor for pseudorabies and swine brucellosis. This type of sampling does not always lead to ideal distributions of samples for disease monitoring.

In addition to national disease monitoring projects, APHIS-WS has occasionally collected additional samples for disease monitoring and research projects conducted in cooperation with Federal and State agencies and research institutions. Depending upon the funding source, sampling for these projects may involve collecting samples from swine already obtained by hunters or for damage management or it may include obtaining feral swine specifically for disease sampling in accordance with survey or research protocols.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

Under this alternative, APHIS-WS and VS would have shared responsibilities to monitor for diseases in feral swine. In conducting the national program for feral swine, APHIS would use risk-based modeling to determine locations and populations that should be targeted for disease sampling. APHIS-VS at this time has identified five diseases to be incorporated in a national monitoring program: classical swine fever, swine brucellosis, porcine reproductive and respiratory syndrome (PRRS), swine influenza, and pseudorabies. These diseases may change depending on needs. APHIS-WS would collaborate with APHIS-VS to identify locations where disease transmission is of greatest concern due to potential for livestock and feral swine interface, and then would target monitoring efforts at those locations. APHIS-VS would also provide general guidance and support for diagnostic tests conducted through the National Veterinary Services Laboratories and collaborating laboratories. In addition to the diseases included in the national monitoring program, APHIS-WS would collect biological samples from feral swine in collaboration with Federal, State, and local animal health officials and research institutions to support research activities assessing new disease risks.

APHIS would also work with the United States Department of Health and Human Services, the Centers for Disease Control and Prevention, and the One Health Coordinating Office on projects to monitor for diseases of public health concern.

These partnerships would provide information to guide risk mitigation for zoonotic pathogens, such as pathogenic Escherichia coli, leptospirosis, and Salmonella. These efforts would directly support APHIS' efforts to address zoonotic diseases in animals, and Health and Human Services' goal to advance the health, safety, and well-being of the American people by reducing the occurrence of infectious diseases. The strong inter-departmental working relationships among agencies would increase the emergency response capacities across all agencies.

#### *c. Alternative 3: Baseline FSDM Program*

Under this alternative, all funds would be allocated to baseline FSDM in the states and territories. No additional resources would be available for disease surveillance and monitoring. These activities would occur in the same manner as described for Alternative 1. Due to the substantial increase in FSDM, APHIS-WS would have access to a larger number of feral swine for sampling from a wider range of areas. However, resources for testing the samples would not be available unless provided by cooperating agencies and research institutions.

#### *d. Alternative 4: National FSDM and Strategic Local Projects*

All funds would be allocated to national priority projects which include monitoring for diseases of concern to human and animal health. Design of monitoring protocols, and collection and testing of samples would occur in the same manner as for the Integrated FSDM Program (Alternative 2). Baseline funding would not be available in all states with feral swine, so it would be necessary to allocate funds specifically for disease monitoring in States, Territories, and Tribal lands which are not identified as national priorities for FSDM.

#### *e. Alternative 5: Federal FSDM Grant Program*

APHIS-WS activities would be limited to coordinating FSDM activities through the allocation of grants. No APHIS-WS personnel would be involved in operational FSDM, so some efficiency in collecting samples opportunistically from swine taken for damage management would be lost. Samples could be collected by entities working under grants, but the national coordination of sampling effort and processing of samples would be limited unless some funds are reserved for APHIS involvement in this function. APHIS-VS would not receive additional funds to test samples or develop improved monitoring protocols other than those funds allocated from other sources to meet existing program obligations as under the current FSDM program (Alternative 1). Overall capacity to conduct disease monitoring to protect agriculture and human health would likely be intermediate to the Current FSDM Program (Alternative 1) and the Integrated FSDM Program (Alternative 2).

**4. Develop and improve tools and methods to manage feral swine populations, predictive models to assess feral swine population expansion and economic impacts, and risk analyses for feral swine impacts to agriculture, animal health, and human health.**

***a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)***

The NWRC currently conducts research projects on an extensive array of issues related to feral swine within the constraints of available funding. These research areas include:

- Feasible toxicants and delivery systems to control feral swine;
- Patterns of feral swine movement and potential disease transference between feral swine and domestic animals;
- Effectiveness of various feral swine exclusion devices;
- Population estimation techniques;
- Baits for pharmaceutical delivery;
- Attractants for feral swine;
- Fertility control agents;
- Feral swine behaviors in response to damage control activities;
- Economic analysis of feral swine damage;
- Economic considerations for implementing management strategies;
- Ecological investigations addressing feral swine impacts on agriculture and the environment.

NWRC regularly collaborates with other government agencies, universities, and private organizations to conduct research activities. Currently, the highest priority for feral swine research conducted by NWRC is assessing the feasibility of using sodium nitrite, a feral swine toxicant developed in Australia, to safely reduce feral swine populations. Another related high-priority study focuses on developing a delivery system to dispense baits to feral swine while limiting access to non-target species.

APHIS-VS Center for Epidemiology and Animal Health (CEAH) develops models for assessment of risks posed to livestock – primarily from diseases. Feral swine may be included in these risk assessments if they play a role in the overall risk from the disease. The CEAH are also developing models to address the overall wildlife component as a factor in livestock health, which would include, but is not limited to feral swine.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

The additional funding provided under this alternative would increase the capacity of the NWRC to work on multiple projects concurrently. NWRC would continue to develop or modify new capture devices and to evaluate efficacy and efficiency of existing and new methods, including potential reproductive inhibiters. As directed by Congress in the 2014 appropriations (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2014, Public Law No. 113-76 2014), research into reproductive inhibitors would include working collaboratively with other agencies and university researchers on the development of non-hormonal, species-specific oral contraceptives, such as phage-peptide constructs. NWRC also would investigate the potential for emerging technologies to be incorporated in feral swine control and monitoring activities. Another role of research would be developing and evaluating possible performance measurements for monitoring accomplishments of the APHIS feral swine program.

Baseline funding enables all APHIS-WS state programs in areas with feral swine to have some staff available for FSDM. These staff members can often collect samples and other data for research projects during the course of their regular FSDM activities or with minimal additional funding. This increases the collective range and research capacity of APHIS research activities without the cost of hiring new staff for each area where samples are needed.

APHIS-VS also would contribute to feral swine research. The APHIS-VS Science Technology and Analysis Services (STAS) staff would integrate existing knowledge to develop disease risk models to estimate potential impacts of feral swine on domestic agriculture animals. Epidemiologic data gathered during disease monitoring activities would also be of value in populating risk models. These models would be used in developing and evaluating future strategies for monitoring feral swine diseases and removal activities. APHIS-VS staff would collaborate with APHIS-WS to refine existing maps of feral swine distribution and create habitat models to predict where future feral swine establishment may occur. APHIS-VS' STAS Wildlife Livestock Disease Investigations Team would develop technologies towards remote detection of infectious diseases in feral swine (e.g., brucellosis, TB). They would also develop and evaluate population and disease management methods for feral swine, such as vaccines, contraceptives, and vaccine delivery methods.

### *c. Alternative 3: Baseline FSDM Program*

Under this alternative, all FSDM funds would be allocated to baseline damage management with the exception of funding provided for the development of non-hormonal, species-specific oral contraceptives, such as phage-peptide constructs, as directed by Congress (Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2014, Public Law No. 113-76 2014). All other research and development activities conducted by NWRC and APHIS-VS would be as discussed for the Current FSDM Program (Alternative 1).

### *d. Alternative 4: National FSDM and Strategic Local Projects*

Research and development are included in the national FSDM priority projects as described for the Integrated FSDM Program (Alternative 2). Implementation of research and development would be conducted in the same manner as for the Integrated FSDM Program (Alternative 2). There is likely to be more funding available for research and other national priority projects than under the Integrated FSDM Program (Alternative 2) because no funding would be allocated to baseline program capacity.

This alternative may be less cost-efficient in conducting research and collecting data for large scale projects than the Integrated FSDM Program (Alternative 2). In the absence of baseline funding, some APHIS-WS state programs in areas with feral swine may not have staff available for FSDM, and alternative strategies would be needed to collect samples over large areas. In these situations, additional time and effort may be needed to collect samples for projects covering large portions of the country.

### *e. Alternative 5: Federal FSDM Grant Program*

Under this alternative, no research or operational FSDM would be conducted by APHIS-WS. Instead, APHIS would use a grants process to allocate funds to universities and other research institutions to conduct research in areas of interest. As a one-of-a-kind leader in research on human-wildlife conflict management, the NWRC has over 120 years of experience in the development of wildlife damage management techniques and registration of damage management products.[11] These skills would not be available under this alternative which could have a substantial adverse impact on development of toxicants and reproductive inhibitors for FSDM. Similar loss of APHIS-VS knowledge and expertise would also impact development of disease risk models and resulting improvements in

[11] The NWRC has its origins in the Division of Economic Ornithology established in 1886, the USDA Control Methods Research Laboratory established in 1905 and the USDA Food Habit Laboratory Established in 1931.

damage management efforts. Additionally, no APHIS-WS operations staff would be available to help with data collection and research for large-scale projects.

5. **Develop outreach materials and activities to educate the public about feral swine damage and related activities to prevent or reduce damage.**

### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

Education is a key component of effective FSDM. Elected officials, agency managers, and the public need accurate information on the costs and benefits of feral swine, effective management strategies, and the consequences of individual actions pertaining to feral swine (e.g., releasing swine into natural areas). Effective outreach programs can influence social norms and behaviors which impact feral swine populations (e.g., transporting and releasing feral swine). This information can also help elected officials make informed decisions when developing effective local regulatory options to meet the management objectives of their constituents.

At present, APHIS has produced a limited number of materials (two brochures and a traveling display) on feral swine and FSDM. Additional educational materials have been produced collaboratively with Universities and State agencies. Time and resources for FSDM outreach efforts are weighed against similar needs for other APHIS program activities. APHIS personnel participate in professional conferences and educational programs to exchange information on current program activities, research developments and to provide education on feral swine damage and damage management techniques. APHIS provides site-specific technical assistance on FSDM when requested as time and available resources allow.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

This alternative would provide dedicated funds specifically for national FSDM outreach and educational materials. This serves the dual purpose of increasing the agency's capacity for FSDM outreach but also has the indirect benefit of freeing base APHIS funds for outreach on other APHIS priority areas. Proposals for an expanded outreach program include a social media communication program with weekly messages on FSDM; outreach materials including brochures and fact sheets which can be customized to meet local needs; improved online materials to be used by agencies and the public; additional traveling displays for use at fairs, industry meetings and other gatherings; and print advertisements. Resources would also be available to assess the effectiveness of outreach strategies. APHIS includes technical assistance (advice) on FSDM with all operational activities. The increase in capacity to conduct FSDM activities would substantially increase opportunities to provide site specific advice to landowners, communities, and agencies seeking to address conflicts with feral swine.

### *c. Alternative 3: Baseline FSDM Program*

This alternative would not provide funding for national-level projects, so there would be no nationally-coordinated outreach and education program under this alternative. However, outreach and education is a critical component of any FSDM project and APHIS-WS state programs could use some of their resources for increased local education and outreach efforts. The increase in capacity to conduct FSDM activities at the APHIS-WS state program level would substantially increase opportunities to provide site specific advice to landowners, communities, and agencies seeking to address conflicts with feral swine. However, these efforts are likely to lack some of the benefits of a national coordinated education and outreach program including research and evaluation to improve the efficacy of outreach and educational efforts. Overall education and outreach efforts are likely to be greater than the Current FSDM Program (Alternative 1), but less than the Integrated FSDM Program (Alternative 2), National FSDM and Strategic Local Projects Program (Alternative 4), and the Federal Grants Program (Alternative 5).

### *d. Alternative 4: National FSDM and Strategic Local Projects*

As with the Integrated FSDM Program (Alternative 2), this alternative would provide dedicated funds specifically for national FSDM outreach and educational materials. National outreach and education activities and impacts would be as described for Alternative 2. No funds would be available for baseline FSDM, so opportunities for site specific technical assistance (advice) on FSDM during operational activities would be limited for States and Territories which are not identified as national priorities for feral swine eradication or included in strategic local projects. Overall impacts are likely to be similar to or less than the Integrated FSDM Program (Alternative 2) and greater than the Current FSDM Program (Alternative 1), Baseline Program (Alternative 2), and Federal Grants Program (Alternative 5).

### *e. Alternative 5: Federal FSDM Grant Program*

Under this alternative, APHIS could request and allocate grants for the development of outreach and education programs. Given the reduction in funds for project implementation expected under this alternative, it is likely that there would be fewer resources for the development of these projects than under the Integrated FSDM Program (Alternative 2). APHIS-WS would not be involved in any operational FSDM. Technical assistance and all other local education and outreach would need to be provided by the grant recipients and may not be as consistently available as under the Integrated FSDM Program (Alternative 2).

**6. Coordinate with Canada and Mexico to establish a collaborative plan to address the feral swine threat along the common borders.**

***a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)***

Feral swine are known to move across the borders between the United States and neighboring countries. These movements provide a potential avenue for introduction of feral swine into areas where they do not currently occur. Under the current program, coordination with Canada and Mexico occurs on a limited basis and primarily consists of communications between individual states and adjacent portions of Canada and Mexico. The NWDP collaborates with Canada and Mexico on wildlife disease issues including those impacting feral swine on a somewhat limited basis. APHIS-WS may occasionally provide technical assistance to states on request. National level communication and coordination is generally limited to APHIS-VS and IS actions required to facilitate international trade and movement of animals.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

This alternative would provide national coordination on issues associated with feral swine along international borders with Mexico and Canada. APHIS would rely on APHIS-VS and -WS expertise and -IS to develop collaborative plans with Mexico and Canada. These collaborative efforts would assess movements of feral swine across borders. These efforts would include:

- Establishing an information exchange agreement with Canadian and Mexican counterparts on feral swine movements and possibly disease surveillance information;
- Developing a comprehensive border plan with Mexico and Canada federal representatives, identifying regions with feral swine, estimating populations and evaluating agriculture damage and disease risks;
- Evaluating potential benefits for providing training on capturing, handling, and collecting biological samples from feral swine;

***c. Alternative 3: Baseline FSDM Program***

National coordination of FSDM would be limited under this alternative, because all funding would be allocated to APHIS-WS state programs for baseline damage management in cooperation with agency partners, Tribes, private organizations, and individuals. Coordination with Canada and Mexico would be similar to the Current FSDM Program (Alternative 1).

#### *d. Alternative 4: National FSDM and Strategic Local Projects*

This alternative implements the national projects and strategic local projects components of the Integrated FSDM Program (Alternative 2). Coordination with Canada and Mexico under this alternative would be identical to the Integrated FSDM Program (Alternative 2).

#### *e. Alternative 5: Federal FSDM Grant Program*

Coordination would only occur on the local level and would not involve the APHIS-WS program because APHIS-WS actions would be limited to coordinating the grants program so that it meets management objectives. APHIS-VS and IS coordination with Canada and Mexico would be identical to Alternative 1.

## C. Environmental Consequences

### 1. Impact on Threatened and Endangered Species and Critical Habitats

The FWS and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) share regulatory responsibility for implementing the ESA (Sections 1.I, Authorities, and Roles, and 3.E. Regulatory Environment). Generally, FWS manages land and freshwater species, while NMFS manages marine and anadromous species. APHIS-WS maintains close partnerships with the FWS at the national, regional and local levels, to ensure that FSDM actions do not jeopardize species that are listed as threatened and endangered (T&E) under the ESA. Most species potentially adversely affected by FSDM actions fall under the jurisdiction of FWS; however, some actions could potentially affect species managed by NMFS (e.g. salmonids or sea turtles), therefore it is possible that APHIS-WS would also consult with NMFS when or if this situation arose.

Section 7 of the ESA, entitled "Interagency Cooperation," requires all federal agencies to ensure that the actions they take, including those they fund or authorize, do not jeopardize the existence of any T&E species. Pursuant to the ESA, APHIS-WS consults with the FWS and/or NMFS if proposed FSDM actions may affect T&E species. The consultations may be either formal or informal, depending upon the potential effects and the risk of take[12] of a T&E species. Very often, Standard Operating Procedures (SOPs) (Section 2.C.E) are already built into the proposed action to minimize the potential for harm (Chapter 2 Section G; Appendix E). Where appropriate, however, APHIS-WS and FWS/NMFS collaboratively develop additional measures to further minimize the potential for harm and these are adopted into project management planning and implementation.

[12] "Take" includes actions which result in the disturbance, capture, injury or death of a listed species and habitat modifications or degradation that significantly impairs essential behavior patterns.

Section 7 consultation processes to address program impacts on ESA protected species and critical habitats were considered during the development of this EIS, and a blueprint for analysis was developed. The blueprint for analysis was developed to guide local consultations instead of a comprehensive or programmatic formal consultation for several reasons:

- this EIS has a broad geographic scope which cannot as yet identify all specific potential impact locations and affected ESA resources. (e.g., developing assessments and identifying minimization measures for every T&E plant species from FSDM cannot be effectively or efficiently handled at the national level);

- all ESA consultations for current FSDM programs, including all methods currently in use by APHIS, have already been completed, primarily at the APHIS-WS state program or local level, but also at the regional and national level for some species;

- partnerships with an array of other Federal, State, Territorial, Tribal, and local agencies and organizations would be formed under the Integrated FSDM Program (Alternative 2) and other alternatives. It is premature to determine which land areas, particular strategies, affected resources, and additional legal and protective measures would be in play in these potential future partnerships; and

- local level ESA compliance should be done in collaboration with partner agencies and consider their ESA compliance needs and the measures they may already have in place.

The blueprint for ESA analysis identifies the full array of potential FSDM actions that could be implemented for all alternatives, the types of species that could be affected by the FSDM actions, how or why the species may be affected, the APHIS SOPs or other measures that would be in place to minimize harm, and actions that may still require Section 7 consultations. This information is provided in Appendix E. Additional Section 7 consultations that may be required if APHIS expands FSDM programs would be completed at the local, State, Territorial or regional levels as appropriate.

***a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)***

To date, APHIS-WS ESA Section 7 consultations at the State, local, regional, and national levels on the Current FSDM Program have never resulted in conclusions that Current FSDM Program, including cumulative effects,[13] would jeopardize the continued existence of any T&E species or result in the destruction or adverse

[13] FWS considers cumulative effects under Section 7 of the ESA when it issues Biological Opinions on formal consultations. Cumulative impacts under the ESA encompass only effects of future state or private activities reasonably certain to occur within the action area subject to Federal consultation (50 CFR § 402.02). ESA cumulative effects should not be confused with cumulative effects under NEPA, which applies a broader definition.

modification of designated critical habitats. When local FSDM programs change to include new work areas, when new ESA listings are designated, or when other program or environmental changes occur that may affect T&E species, APHIS-WS reinitiates ESA consultations to ensure that the program continues to comply with the ESA and to ensure that jeopardy to any species or critical habitat is avoided.

Considering Potential Adverse Effects of FSDM

Potential risks to T&E species from currently available FSDM methods generally involve five classes of impacts:

- disturbance of T&E species by movement of people, aircraft, vehicles, horses, or dogs;
- damage to T&E vegetation and habitats used by T&E species associated with movement of people, vehicles, and horses through project areas and concentrated swine activity in the area, or burial of carcasses;
- risk that leaving carcasses on site may cause localized concentrations of predators and scavengers near vulnerable T&E species (e.g., ground nesting birds);
- risks to T&E predators and scavengers from lead ammunition;
- risks of unintentional capture, injury, or death of a T&E species in a device set to capture feral swine.

Risk of disturbing T&E species is generally addressed through coordination and consultation with the Federal agencies, State/Territorial agencies, Tribes, and landowners/managers. Sensitive areas are identified and either avoided at all times, avoided seasonally during periods where impacts may occur (e.g., breeding season), or, for species which occur irregularly, avoided if the species is detected in the project area. With implementation of these types of measures, APHIS-WS actions usually either have no effect on, or may affect T&E species; they are unlikely to adversely affect T&E species because of disturbance.

Similar to disturbance, many of the risks to vegetation and habitats used by T&E species from APHIS-WS FSDM activities are mitigated through coordination with the necessary Federal agencies, State/Territorial agencies, Tribes, and landowners/managers to identify and avoid areas with T&E plant species. Additionally, APHIS-WS uses established roads and trails to the maximum extent practicable. Preference is given to locating carcass disposal sites, corral and cage trap sites, and bait sites in areas which are already disturbed by agriculture or other land uses and sites which have already been damaged by swine. In remote areas and sites with sensitive soils and vegetation, aerial shooting may be a preferred method because of the decreased need for movement of people and equipment through the project site. With implementation of these types of measures, APHIS-WS actions usually either have no effect, or may affect but are unlikely to adversely affect T&E vegetation and habitats used by T&E species.

Concentration of feral swine carcasses in one area, such as may occur in areas where cage traps are used, has the potential to temporarily attract concentrations of predators and scavengers to a site at levels which may not otherwise occur. The increase in predator and scavenger activity may pose temporary risks to nearby T&E species, particularly species which may be at greater risks of predation during the breeding season. APHIS-WS works with the FWS, State/Territorial agencies, Tribes, and landowners/managers to identify locations and seasons when these types of impacts may occur. Potential procedures to minimize risk may include carcass removal or scheduling of project activities during periods when the T&E species is not present or is less vulnerable to predation. With implementation of these types of measures APHIS-WS actions usually either have no effect or may affect but are unlikely to adversely affect T&E species.

The issue of risks to non-target species from lead ammunition is discussed in detail in Section C. 3 below. The APHIS-WS program is working to shift to non-toxic ammunition in situations where it is practical and effective. However, there are currently substantial impediments to this effort. APHIS-WS has very specific ammunition performance requirements and nontoxic ammunition options which meet these requirements are not yet available for all types of firearms which may be used for FSDM. In other cases, as with ammunition for use in shotguns, difficulties with availability of ammunition and cost of ammunition are a limiting factor. APHIS-WS does not use lead ammunition in areas where it is prohibited to do so for the protection of T&E species (e.g., for the protection of California condor). Other strategies to reduce risk from lead ammunition include retrieval of carcasses or rendering carcasses inaccessible to predators and scavengers through on-site burial. Risks associated with the use of lead ammunition run the range from “no effect” to “may effect” and may require informal or formal consultation with the FWS. Consultations are completed whenever a proposed program may adversely affect T&E species. For example, a consultation has been completed addressing the effects of potential lead toxicity on the California condor.

APHIS-WS personnel are experienced and trained in the selection and use of capture methods to reduce risks to non-target species. Risks of inadvertent capture of non-target species are greatest for cage traps, snares, and foothold traps. Non-target species can generally be released unharmed from cage traps. Risks associated with the use of traps and snares may be mitigated through avoidance of areas where T&E species occur, avoidance of placement of traps and snares in areas with evidence of use by T&E species, bait selection, use of pan-tension devices which reduce the risk that an animal smaller than the target species may be captured, and frequent (daily) trap checks. Depending on the T&E species in question and the SOPs, which can include FWS or partner agency recommendations or requirements, risks to T&E species from capture devices range from "no-effect" to "may affect" and may require formal or informal consultation with the FWS.

APHIS-WS has received national/regional Biological Opinions on current program effects, including FSDM methods that may affect T&E species (primarily foot-hold traps; foot, leg, and neck snares, ground and aerial shooting, and vehicle use) on: ocelot (*Leopardus pardalis*) (July 2010); jaguar (*Panthera onca*) (1999[14]); and Mexican wolf (*Canis lupus baileyi*) (July 2011). APHIS-WS has completed informal and/or formal consultations with FWS at the APHIS-WS state program or local (specific project or region within State) level for program effects on a number of species that may be affected by FSDM including, but not limited to: California condor (*Gymnogyps californianus)*, whooping crane (*Grus americana*), desert tortoise *(Gopherus agassizii);* San Joaquin kit fox (*Vulpes macrotis mutica*); grizzly bear (*Ursus arctos horribilis*); Louisiana black bear (*Ursus americanus luteolus)*; Columbian white-tailed deer (*Odocoileus virginianus leucurus);* jaguarundi (*Felis yagouaroundi cacomitli*); Canada lynx (*Lynx canadensis*); Florida panther (*Puma (=felis) concolor cor*yi); Sonoran pronghorn (*Antilocapra americana sonoriensis*); gray wolf (*Canis lupus*), and red wolf (*Canis lupus rufus).* APHIS-WS has consulted with the FWS on these species because these are all species that may be affected by FSDM operations depending upon where local programs are implemented and what methods are used. In cases where unintentional take may occur in spite of implementation of Reasonable and Prudent Measures established in formal consultation with the FWS, the FWS has issued incidental take statements and terms and conditions for the APHIS-WS action. However, in no instance has the potential take by APHIS-WS been found to pose a risk of jeopardy to a federally-listed T&E species or critical habitat. In all cases, when new information is available that may change the determination of effects on T&E species or critical habitats, APHIS-WS would consult with the FWS (or NOAA) as appropriate. Based on ESA consultation requirements and the consultation history of the APHIS-WS program, WS believes that no significant adverse effects on ESA protected species or critical habitats would occur under this alternative.

Considering Potential Beneficial Effects of FSDM

ESA consultations are required when the FSDM program *may affect* T&E species or critical habitats and this includes effects that are purely beneficial. The Current FSDM Program may provide benefit to many T&E species and critical habitats.

[14] The 1999 BO on jaguar was reviewed by the FWS in 2012 and deemed still complete and effective.

However, APHIS-WS does not claim to have a *beneficial effect,* by ESA definition, if the effect also occurs with negative program effects, even when they are not likely, and even when the net effect is positive. A beneficial effect must also occur contemporaneously with the project, and if it is indirect, it must be traceable and predictable to the point where the benefit to the individual resource can be clearly identified. Where beneficial effects are identified, APHIS-WS ESA consultations examine those effects. Based on ESA definitions, beneficial effects conclusions on their own are not typical. Still, based on information in Chapter 3 Section C – Natural Resources, it is intuitive and reasonable to conclude from a broader perspective that the removal or reduction of populations of feral swine would benefit numerous T&E species and their critical habitats. Feral swine that are removed cannot harm T&E species on another property at a later time, or continue to destroy resources where a FSDM project removes them.

APHIS-WS is involved in a number of projects to protect T&E species from feral swine depredation. For example, APHIS-WS is involved in projects to reduce feral swine predation on eggs of the federally threatened green sea turtle (*Chelonia mydas*) in Guam. On St. Vincent National Wildlife Refuge in Florida, feral swine have been documented preying on half of the known nests of the endangered loggerhead sea turtles. The population of the turtles is in steep decline and removal of the swine has been recommended to enhance production of juvenile turtles. In Missouri, feral swine have damaged the federally threatened and state endangered Mead’s milkweed by rooting up the plant during feeding. The plant's igneous glade habitat found in the Missouri Ozarks has also been damaged by feral swine rooting activity. The federally endangered Hine’s emerald dragonfly is also directly affected by feral swine. The dragonfly is found in Reynolds County located in the Missouri Ozark fen[15] complex. Feral swine utilize these fens to wallow in, frequently causing significant damage. The Hine's emerald dragonfly deposits its eggs in slow moving streams also utilized by feral swine. These programs are just a few examples of how FSDM may be implemented to benefit T&E species.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

Considering Potential Adverse Effects of FSDM

Under the Integrated FSDM Program alternative, FSDM actions would include the same management methods which may affect T&E species or critical habitats as the Current FSDM Program (Alternative 1). However, some methods which are available but have not yet been employed by APHIS-WS state programs, including, but not limited to, drop nets, composting, chemical digesters, incineration, and rendering, would be more likely to be used under this alternative.

[15] A fen is a type of wetland that is low and marshy or frequently flooded.

Use of GonaCon™ injections as a reproductive inhibitor could be used under this alternative if the product is registered with EPA for use in feral swine. The toxicant sodium nitrite, and GonaCon™ and other reproductive inhibitor formulations that allow for delivery in feed bait are under development. Assessment of impacts is dependent upon details of product formulation and delivery, which are not fully known and cannot be assessed at this time. As products approach field applications, Risk Assessments will be prepared and appropriate NEPA review will be conducted at the local or national level as appropriate.

This alternative would substantially increase the level of FSDM which could be conducted on State, Territories, and Tribal lands with feral swine. As discussed under the Current FSDM Program (Alternative 1), ESA consultations are already completed for most of the available FSDM methods. These consultations may need to be reinitiated to address expanded programs if FSDM operations would be conducted in new areas with species or habitats not previously considered, or if the use of methods that may adversely affect feral swine would increase substantially and thus increase risks in a manner not previously considered. Typically, APHIS-WS methods are evaluated on a statewide basis for all T&E species, and standard operating procedures and other minimization measures keep risks to T&E species low or unlikely. Where there is an allowance for incidental take, based on a formal ESA consultation, similar reasoning would apply. In all cases, when new information is available that may change the determination of effects on T&E species or critical habitats, APHIS-WS would consult with the FWS (or NOAA) as appropriate. Appendix E provides a description of the specific activities and scenarios where consultations may be needed to comply with the ESA. No actions would occur without review of program effects on T&E species and the appropriate ESA consultations, documentation, approvals, and decisions. While a jeopardy determination is not expected on any aspect of FSDM under the Integrated FSDM Program, APHIS would not proceed with any action that the FWS has determined could jeopardize the continued existence of any federally listed threatened or endangered species, or that would adversely modify or destroy designated critical habitat.

Additional consultation may also be needed for methods available but not currently in use by operational programs. Given that adverse impacts on habitats and adverse impacts from disturbance can usually be avoided through coordination with the FWS, agency partners, Tribes, and landowners/managers, we do not expect use of drop nets, composting, chemical digesters, incineration, and rendering to result in adverse impacts on T&E species or their habitats. For example, drop nets are only triggered as directed by an operator. Operators would not activate the devices if a T&E species were in the area affected by the device, so there is minimal risk of unintentional capture, injury, or death of a T&E species from the use of this method.

Considering Potential Beneficial Effects of FSDM

On balance, the potential for benefit to T&E species and critical habitats is much greater than any potential for harm. Compared with the Current FSDM Program and the other alternatives, the potential benefit to T&E species would be greatest under this alternative because it has the greatest potential to efficiently eliminate feral swine from states with low populations and whose management objectives are eradication. It also has the greatest potential for successful localized elimination or damage control in states with larger feral swine populations and thus, T&E species would likely benefit indirectly.

**c. Alternative 3: Baseline FSDM Program**

Considering Potential Adverse Effects of FSDM

Alternative 3 provides funding only to baseline FSDM operations, wherein all funding would go to APHIS-WS state programs with operational FSDM programs to support partnerships in the states and funding would be allocated based on feral swine populations. No funding would go towards national projects, such as research or method development. Thus, in the short term, this alternative would see the greatest level of FSDM operational activity, with corresponding increased potential for risks to T&E species and critical habitats. The discussion of potential effects on T&E species and ESA consultation requirements would be similar to Alternative 2, where consultations are already in place for ongoing programs. Expanded or new programs may require additional consultation for new information including new program locations, T&E species and critical habitats, and differing or more intensive use of existing FSDM methods. Appendix E provides a description of the specific actions and scenarios where consultations may be needed to comply with the ESA.

Considering Potential Beneficial Effects of FSDM

In the short term, this alternative would see the greatest level of FSDM operational activity. Benefits would be expected to correspond, especially where projects are focused to specifically benefit individual T&E populations and critical habitats. In states with large feral swine populations, this alternative may provide the greatest potential for short term local benefits to T&E species because funds would be allocated to states based on the size of their existing feral swine population. The loss of funding for national and strategic local projects would likely have an adverse impact on States and Territories with low overall feral swine populations because baseline funding may not be sufficient to address local risks to T&E species. In the long term, without the support of national level projects to create more efficiencies, (e.g. from research, national-level education, and outreach programs and material), and a nationally coordinated effort to stabilize and eventually reduce the feral swine population, this alternative is likely to be less effective in eliminating feral swine and reducing local damages than the Integrated FSDM Program (Alternative 2). Therefore, ultimately, this alternative would be likely to provide less benefit to T&E species and critical habitats.

***d. Alternative 4: National FSDM and Strategic Local Projects***

This alternative would not provide baseline capacity funding for all APHIS-WS state programs in areas with feral swine. Consequently, some States, Territories, and Tribal lands with high feral swine populations and/or which do not intend to eradicate feral swine populations (Figure 1) may not receive any funding for baseline operational work. In those cases, effects on T&E species and critical habitats would be similar to the Current FSDM Program (Alternative 1). Where states receive funding for strategic local projects, focused, intensive operations would be implemented to eradicate feral swine, and potential effects, both negative and positive would apply.

Considering Beneficial Effects of FSDM

Benefits to T&E species would be based on potential exposure to feral swine, and the removal of that potential negative effect.

This alternative would apply more funding to national projects (e.g. research, national-level education and outreach programs and materials) than any other alternative, so it would likely provide beneficial effects based on long-term efficiency and efficacy in developing tools and improving public understanding of the need to stabilize and reduce the feral swine population. Potential benefits would likely be achieved more quickly under this alternative where strategic local projects were implemented than under the remaining alternatives. However, in the interim, states which are low priorities for FSDM will receive little additional support for projects to protect endangered species.

***e. Alternative 5: Federal FSDM Grant Program***

Considering Adverse Effects of FSDM

APHIS-WS would not directly affect ESA T&E species or critical habitats under this alternative because it would not implement FSDM operations. However, ESA obligations also apply to actions with a significant federal nexus, including funding. APHIS-WS would work with grant applicants to ensure that risks to T&E species had been considered and the FWS consulted for actions which may affect T&E species or which may adversely affect, modify, or destroy critical habitats. Implementation of this alternative would require APHIS to commit a substantial amount of funding to oversight, compliance, and monitoring. Risks to ESA listed T&E species would be related to the degree that grant recipients followed protocol established for resource protections. ESA consultations are already in place for APHIS-WS activities for all other alternatives. ESA compliance processes on broad programs with multiple effects can require significant resources for both the action agency and the FWS. The FSDM Grant Program presents substantial regulatory compliance inefficiency because, while existing APHIS-WS ESA consultations may either be adequate or simply require relatively minor updates for most other alternatives, ESA consultations under this alternative would need to be initiated anew for all grant recipients.

Increases in costs for program administration and supervision would decrease funds available for operational FSDM. Whether or not this alternative might provide similar or greater benefits than the Current FSDM Program (Alternative 1) would depend greatly on the efficiency of the entities who deliver FSDM services. Assuming the grant recipients are as effective as the APHIS-WS program, the reduction in funding would result in lower benefits than under the Integrated FSDM Program (Alternative 2), Baseline Funding Program (Alternative 3) and National and Strategic Local FSDM Program (Alternative 4). Loss of NWRC experience and skills in product development and registration may slow the development of toxicants and reproductive inhibitors which could adversely impact program efficacy, particularly in states with substantial feral swine populations (see Efficacy of methods Section B.1.a above).

Considering Beneficial Effects of FSDM

While APHIS programs would not implement operations designed to protect T&E species from feral swine damage, entities could apply for grants to receive funding for projects to protect T&E species. In addition, there may be indirect benefits to T&E species and critical habitats by removing feral swine for other purposes. This alternative is not likely to provide as much potential benefit to T&E species and critical habitats negatively affected by feral swine because fewer feral swine would likely be eradicated or removed.

**2. Impact on Non-target Animals**

Many animal species can benefit from FSDM because removal of feral swine can be expected to reduce the potential for predation, competition for food, and damage to their habitats (Chapter 3 Section C.1.c). On the other hand, non-target species could be impacted by FSDM methods, whether implemented by APHIS-WS, other agencies, or the public. Tools used to control or capture feral swine can result in some level of negative effects on non-target animals. Specifically, foot snares and foothold traps have the potential to directly capture non-target animals and may harm or kill individual animals. Neck snares also have the potential to capture and harm or kill non-target animals. Non-target animals may also be captured and not harmed, for example, by entering a cage or corral trap. In these cases, the animal can usually either escape or be released without harm. Trained wildlife specialists who use lead ammunition have little potential to directly harm non-target animals. However, spent lead ammunition can be toxic when ingested by scavengers. This will be minimized by exhausting supplies of effective non-toxic ammunition when possible before using toxic ammunition.

Research into sodium nitrite, a toxicant, and feed-based reproductive inhibitors, is ongoing and may eventually be evaluated under NEPA for inclusion in FSDM. APHIS-WS believes that these methods will be important for program delivery in the future, but operational use of sodium nitrite and feed-based reproductive inhibitors is not proposed under any of the alternatives in this EIS because insufficient information is available currently for decision making and planning for programmatic use. Proposals to use these products, if registered for use under any alternative, would be subject to additional NEPA review, when and if the products are developed and registered for field use.

SOPs are often incorporated into FSDM to reduce impacts to non-target species. Various factors such as weather, access, vegetative cover, and land uses can preclude the use of certain methods, so it is important to maintain the widest possible selection of FSDM tools for resolving damage problems. However, the FSDM methods used to resolve damage must comply with legal requirements and be biologically sound. Often, but not always, impacts to non-target species can be minimized. Where impacts occur, they are mostly of low magnitude in terms of non-target species populations.

This section evaluates the positive and negative effects of the alternatives, including the effect of individual management methods on non-target animals. It includes discussion of potential effects on specially protected animals (T&E species, bald and golden eagles, and migratory birds), as well as other species that are biologically less sensitive or with fewer or no legal protections.

#### *a. Alternative 1: Current FSDM Program (No Action Alternative)*

The Current FSDM Program incorporates numerous measures that reduce the potential to affect non-target animals. Methods such as shooting and the use of live traps pose negligible risk to non-target species. While every precaution is taken to safeguard against taking non-target species, other methods, such as animal-activated cage and corral traps, snares, and foothold traps, have the potential to take non-target animals. Some of methods may result in the death of the non-target animals, but other methods may allow the non-target animal to be released on site. The unintentional loss of individual animals, although undesirable, has not been of sufficient magnitude to adversely impact populations of non-target species under the current program.

<u>Risks Associated with Specific Non-lethal Methods</u>

Non-lethal methods are generally regarded as having minimal adverse effects on overall populations of wildlife because the devices are not intended to result in the death of the target animals. However, non-lethal methods have the potential to cause adverse effects to non-target animals primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of feral swine also potentially excludes species that were not the primary reason the barrier was erected. Depending upon the size and location of the barrier system, migratory movements, natural dispersal of young animals, and genetic exchange may potentially be adversely affected. Auditory and visual dispersal methods (i.e., frightening devices) used to reduce damage or threats caused by feral swine would also likely disperse non-target animals in the immediate area where the methods were employed. Target and non-target animals often quickly learn that there is no actual threat associated with the frightening device and cease to respond (i.e., habituate to the device). Consequently, the use of frightening devices is often limited to relatively brief periods when the resource to be protected (e.g., crops) is most vulnerable.

The persistent use of non-lethal methods would likely result in the short term dispersal or abandonment of those areas where non-lethal methods were employed of both target and non-target species. This may result in disruption of short-term seasonal uses of some areas. However, over the long term, habituation is likely to result in non-target animals becoming indifferent to the devices. Although non-lethal methods do not result in death of non-target animals, the use of non-lethal methods can restrict or prevent access of some species to beneficial resources. However, because of problems with feral swine habituating to the devices, non-lethal methods would not be employed over large geographical areas or applied at such intensity that non-target species would be adversely affected. Coordination with the Federal, State, Territorial, and Tribal natural resources agencies and landowners/managers enables APHIS-WS to avoid critical areas used by sensitive species.

Other non-lethal methods available for use under this alternative include live traps (e.g., cage traps, walk-in traps, corral traps) and immobilization drugs. Non-target animals captured in live traps would be handled in such a manner as to minimize stress and risk of injury to the animal. However, despite these efforts, as noted above, some mortality does occur in cage traps. Risks are lowest for the more commonly used walk-in, panel, or “corral”-type cage traps because these traps have open tops and commonly have wider spaces in the panels than enclosed cage traps. These features make it easier for non-target animals to exit the trap, even without human assistance. Risks of mortality are greater for the less frequently used enclosed cage traps. Trap placement in areas where feral swine were active and the use of attractants as specific to feral swine as possible would minimize the likelihood of capture of non-target animals. Similar risks exist for the use of drop nets. However, risks of non-target capture in drop nets are negligible because the devices are activated by an observer. Observers would not activate the traps if a non-target animal was observed in the capture area.

Fencing is a nonlethal method that is used by land managers and has the potential for substantial impacts on non-target species. APHIS does not typically install permanent fencing. Some land management agencies have used extensive fencing systems to protect native habitat or archaeological sites and to partition areas to facilitate systematic removal of invasive animals including feral swine. The scale of some of these fences is much larger than is likely to be the case for agriculture. Fences for most agricultural applications are likely small enough that they do not impact non-target species. Federal land managers who install fencing would be responsible for assessing the effects of their projects on non-target species.

Use of immobilizing drugs would not commonly occur for FSDM. Immobilizing drugs would most likely be used to facilitate safe release of a non-target animal, for research purposes, or for placing telemetry collars on Judas pigs. Immobilizing drugs are applied directly to individual animals from a dart gun, blowgun, or jab-stick. Risks to non-target animals are negligible from the use of this method due to program adherence to label restrictions. However, any time tranquilizers are used on free-ranging animals, there is some risk of mortality. Animals may be stressed from capture or have physical conditions that are not readily apparent, and may affect their response to the drug. All APHIS-WS personnel who use immobilization drugs are trained in the safe use of these methods so risk of unintentional mortality is very low.

Foot and leg snares are similar to neck snares except that they are intended to capture feral swine by the hoof instead of around the neck. Like neck snares, the foot snare consists of a flexible wire hoop made from aircraft cable. Foot snares are placed along the ground; loop pointed up, on active trails and/or bait sites. The smaller loop size prevents larger animals, such as black bears, from accidentally becoming caught. Non-target capture can be reduced through manipulation of the site (*e.g*., brushing in the top of the trail, placing jump sticks), and by regularly checking snares.

Feral swine are generally only captured in foothold traps incidentally to the traps intended placement to capture another species. Foothold traps are not a preferred method for feral swine and are only effective for capture of small swine. Larger animals can usually escape the devices. In areas with feral swine, removal of feral swine is often included as a desired activity on APHIS-WS agreements and the swine are considered a target species. For this reason, even though foothold traps are not normally set for feral swine, non-target animals captured in these locations are being reported as being associated with FSDM. Before foothold traps are employed, their limitations must be considered by WS personnel. Various tension devices can be used to prevent animals smaller than target animals from springing the trap. Trap placement and bait selection can also help minimizing non-target take.

Repellents, if developed and registered as appropriate with the EPA, States, Territories, and Tribes, could be used under this alternative, but additional analysis may be necessary. Any repellents would be used in accordance with label restrictions and instructions. These products are non-lethal and are only expected to be used on agricultural crops, nursery plants, and landscaping. Like frightening devices, effective repellents may also deter non-target species away from desirable habitat or food sources.

Use of repellents may warrant re-initiation of consultation with the FWS regarding potential risks to T&E species. Repellents are generally not intended for application over broad areas and are more commonly applied to specific plants/areas of interest.

APHIS-WS' involvement in the use of or recommendation to use non-lethal methods would ensure the potential effects on non-target species were considered under APHIS-WS' Decision Model (Slate et al. 1992; Figure 2-1). Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations. They also would not be employed over a wide geographical scope that could result in long-term adverse effects to a species' population. Nonlethal methods would also not be employed if their use could concentrate feral swine and adversely affect other species. Nonlethal methods would generally be regarded as having minimal effects on overall populations of wildlife because individuals of those species are unharmed. However, some non-lethal methods may have adverse local impacts on species with small home ranges that cannot disperse beyond the boundaries of the treatment areas. Overall, potential impacts on non-target animals from the use of non-lethal methods would not adversely affect populations because those methods would often be temporary and do not result in lethal removal. Potential impacts on non-target animals under this alternative from the use of and/or the recommendation of non-lethal methods would likely be low.

<u>Risks Associated with Specific Lethal Methods</u>

Lethal methods available for use to manage damage caused by feral swine under this alternative would include, but are not limited to, neck/body snares, shooting (including shooting from aircraft and shooting animals caught in live-capture devices), euthanasia chemicals (applied after live-capture), and the recommendation of hunting.

An incidental risk to non-target species associated with lethal methods is that of carcass disposal. One concern is the potential for disease transmission to non-target species, including domestic animals, from the available carcass disposal methods (Appendix H). In many situations, where it is deemed appropriate, a common method of carcass disposal used by APHIS-WS during FSDM activities is to leave the carcasses on-site to decompose naturally. This will increase scavenging opportunities for wildlife.

Pseudorabies is likely the only disease for which there could be an additive risk to non-target species from on-site disposal of feral swine carcasses (T. Gidlewski, NWRC, pers. comm. 2014). Most domestic animals, including dogs and cats, are susceptible to pseudorabies, but transmission only occurs when these animals are in close proximity to infected swine (ISU 2014). Pseudorabies infection in dogs and cats is generally fatal (ISU 2014). It would be expected that decomposing feral swine carcasses would not likely pose a significant attractant to domestic animals and of greater concern would be if a hunter were to offer a piece of contaminated tissue to a hunting dog while dressing a harvested feral swine (T. Gidlewski, NWRC, pers. comm. 2014). Cramer et al. (2011) reported on the pseudorabies infection of three dogs that were used to hunt feral swine. Two of the three dogs were euthanized due to the severity of their symptoms and third died naturally from the infection. While the risk of pseudorabies transmission to a pet from feral swine carcasses left on site is low, the potential for infection would be high if a pet were to be fed contaminated tissues from an infected swine (T. Gidlewski, NWRC, pers. comm. 2014.).

The risk of disease transmission to non-target species, including domestic animals, of leaving feral swine carcasses on-site is further reduced during the purification process that destroys most disease causing agents. Compared with the shedding stage during early infection, the amount of infectious agent released from an animal after its death is greatly decreased. The temperature of the carcass moves out of the optimal range for pathogen replication the pH in muscle tissue declines, which inactivates many viruses (CAST 2008). In colder climates this process may be slowed, but even in cold climates a carcass of any size will undergo necrosis quickly (T. Gidlewski, NWRC, pers. comm. 2014).

In addition to disease transmission, euthanasia drugs can pose risks to non-target species that consume feral swine carcasses. Although used infrequently for FSDM, euthanasia drugs may pose secondary hazards to scavengers and must be disposed of according to Federal, State, Tribal, county, or local regulations (APHIS-WS Directive 2.515). Further, APHIS-WS personnel will comply with the procedures outlined in the APHIS-WS' Field Operations Manual for the Use of Immobilization and Euthanizing Drugs (2006), which directs that euthanizing drugs will not be used unless the carcass can be incinerated or buried.

Snares restrain pigs with a 12 to 14 inch diameter loop that is securely attached, via the swivel to a firm object, or to a drag. They can be placed where an animal moves through a confined area (*e.g.*, crawl holes under fences, trails through vegetation). Deer stops allow the snare cable to close to a diameter of not less than 2 ½ inches and allow deer or other animals captured by the leg to escape. Snares set for feral swine would likely be set with the top of the loop 15 to 20 inches above the ground. The loop would be low to the ground, making it unlikely that APHIS-WS would catch a deer or bear in a cable restraint. Snares set to capture feral swine by the neck are usually lethal, but stops can be attached to the cable to make it a live-capture device and to close to only a certain diameter to allow deer and other animals to escape. Snares can also take non-target animals of similar size. The cable used to capture feral swine is generally larger in diameter than cable used for smaller animals. This impacts the way the loop closes and helps to reduce risks to smaller non-target animals. Risks to non-target animals are also reduced by placing snares in areas which are extensively used by feral swine and avoiding areas with evidence of use by non-target species that may be vulnerable to the snare, e.g. larger mammals.

APHIS-WS uses specially trained tracking/trailing dogs to locate feral swine. It is APHIS-WS policy (APHIS-WS Directive 2.445) that only trained dogs shall be used by APHIS-WS personnel. The dogs are trained to only pursue the target species. Handlers with the dogs monitor the trail the animals are pursuing and will call back any dog that appears to be following the wrong species. Dogs are most often used in areas with substantial vegetative cover, when locating swine with other methods is difficult. Per APHIS-WS Directive 2.445, all dogs used to track feral swine shall be trained to have minimal to no effect on non-target wildlife species. The use of dogs is not expected to cause the death of a non-target animal or substantively damage wildlife habitat. The primary potential for an adverse effect would be the possible risk of disturbance to ground-nesting birds. However, as discussed previously, the dogs are trained to focus on the target species and are likely to only pass briefly by these birds while in pursuit of feral swine. When selecting appropriate methods for feral swine removal, APHIS-WS State Directors will decide on a case-by-case basis if dogs are the appropriate methods for detection or removal. The use of dogs by APHIS-WS is relatively infrequent in many states. For these reasons, APHIS-WS' use of tracking dogs is not expected adversely affect non-target species populations. NEPA analyses at the state or local level would include discussion of the use of dogs where they may be proposed for use.

The use of firearms is selective for feral swine because animals would be identified prior to shooting. Therefore, no adverse effects on non-target species populations would be anticipated from use of this method. Similarly, euthanasia chemicals are applied directly to the target animal via injection and would not result in the lethal removal of other species. Carcasses of animals killed using euthanasia chemicals would be disposed of in a manner which makes them inaccessible to scavengers (e.g. deep burial) to reduce the risk of adverse impacts on non-target species.

Risks Associated with the Use of Aircraft

Shooting from aircraft can be one of the most efficient methods for removing feral swine in areas where vegetation and terrain do not impede use of this method. Aircraft, including drones, may also be used to conduct surveillance to locate swine or assess feral swine damage (i.e., damage to field crops). Aerial operations would be an important method of FSDM when used to address damage or threats associated with feral swine in remote areas where access is limited due to terrain and habitat. Aerial operations would only occur in those areas where a MOU, work initiation document, or another similar document allowing the use of aircraft had been signed between APHIS-WS and the cooperating landowner or manager and as allowed under the Fish and Wildlife Act of 1956 (16 USC 742j-1, Airborne Hunting). Aerial operations would typically be conducted with aircraft between the months of December and April, when the foliage has fallen, enabling better visibility; however, aircraft could be used at any time of year. The amount of time spent conducting aerial operations varies depending on the severity of damage, the size of the area where damage or threats were occurring, and the weather, as low-level aerial activities would be restricted to visual flight rules and would be impractical in high winds or at times when animals were not easily visible.

Aircraft play an important role in the management of various wildlife species for many agencies. Resource management agencies rely on low flying aircraft to monitor the status of animal populations including large mammals (Lancia et al. 2000), birds of prey (Fuller and Mosher 1987), waterfowl (Bellrose 1976), and colonial waterbirds (Speich 1986). Low-level flights could also be required when aircraft are used to track animal movements by radio telemetry (Gilmer et al. 1981, Samuel and Fuller 1996). However, there is potential for low-level aircraft flights to potentially disturb wildlife, including T&E species.

A number of studies looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed the effects of aircraft overflights on wildlife and suggested that adverse effects could occur to certain species. Some species will frequently or at least occasionally show an adverse response to even minor overflights. In general though, it appears that the more serious potential adverse effects occur when overflights are chronic (*i.e.*, they occur daily or more often over long periods). Chronic exposures generally involve areas near commercial airports and military flight training facilities. Aerial operations conducted by APHIS-WS rarely occur in the same areas on a daily basis and little time is actually spent flying over those particular areas.

The effects of military-type aircraft on wildlife have been studied extensively (Air National Guard 1997), and were found to have no expected adverse effects on wildlife. Examples of species or species groups that have been studied with regard to the issue of aircraft-generated disturbance are as follows:

***Waterbirds and Waterfowl*****:** Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no drastic disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan

1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990) observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50% the following day. They also observed that about 40% of the disturbances caused interruptions in feeding that would require an estimated 32% increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the time/activity budget[16] of the species. Aerial operations conducted by APHIS-WS would not be conducted over Federal, State, or other governmental agency property without the concurrence of the managing entity. Those flights, if requested, would be conducted to reduce threats and damages occurring to natural resources and should not result in impacts to bird species. Thus, there is little to no potential for any adverse effects on waterbirds and waterfowl.

***Raptors*:** The Air National Guard (1997) analyzed and summarized the effects of overflight studies conducted by numerous Federal and State government agencies and private organizations. Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (Air National Guard 1997). A study conducted on the impacts of overflights to bald eagles suggested that the eagles were not sensitive to this type of disturbance (Fraser et al. 1985). During the study, observations were made of more than 850 overflights of active eagle nests. Only two eagles rose out of either their incubation or brooding postures. This study also showed that perched adults were flushed only 10% of the time during aircraft overflights. Evidence also suggests that golden eagles are not highly sensitive to noise or other aircraft disturbances (Ellis 1981, Holthuijzen et al. 1990). Finally, one other study found that eagles were particularly resistant to being flushed from their nests (see Awbrey and Bowles 1990 as cited in Air National Guard (1997)). Therefore, there is considerable evidence that eagles would not be adversely affected by overflights during aerial operations.

Mexican spotted owls (*Strix occidentalis lucida*) (Delaney et al. 1999) did not flush when chain saws and helicopters were greater than 110 yards away; owls flushed to these disturbances at closer distances and were more prone to flush from chain saws than helicopters. Owls returned to their pre-disturbance behavior 10 to 15 minutes following the event and researchers observed no differences in

[16] An animal's activity budget is how it divides its time between activities (e.g. foraging, incubating eggs, building shelter, etc) daily or seasonally.

nest or nestling success (Delaney et al. 1999), which indicates that aircraft flights did not result in adverse effects on owl reproduction or survival.

Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period; results showed similar nesting success between hawks subjected to overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but found that ferruginous hawks (*B. regalis*) were sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, nor did the hawks become alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that five species of hawks, two falcons (*Falco* spp.), and golden eagles (*Aquila chrysaetos*) were "incredibly tolerant" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and the overflights never limited productivity.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards, and from behind occupied cliff nests. Eagle courtship, nesting, and fledglings were not adversely affected, indicating that no special management restrictions were required in the study location.

The above studies indicate raptors were relatively unaffected by aircraft overflights, including those by military aircraft that produce much higher noise levels. Therefore, we conclude that aerial operations would have little or no potential to adversely affect raptors.

***Passerines (e.g. songbirds)*****:** Reproductive losses have been reported in one study of small territorial passerines ("perching" birds that included sparrows and blackbirds) after exposure to low altitude overflights (see Manci et al. 1988 as cited in Air National Guard (1997)), but natural mortality rates of both adults and young are high and variable for most of those species. The research review indicated passerine birds cannot be driven any great distance from a favored food source by a non-specific disturbance, such as military aircraft noise, which indicated quieter noise would have even less effect. Passerines avoid intermittent or unpredictable sources of disturbance more than predictable ones, but return rapidly to feed or roost once the disturbance ceases (Gladwin et al. 1988, United States Forest Service 1992). Those studies and reviews indicated there was little or no potential for aerial operations to cause adverse effects on passerine bird species.

***Pronghorn (antelope) and Mule Deer*:** Krausman et al. (2004) found that Sonoran pronghorn (*Antilocapra americana sonoriensis*) were not adversely affected by military fighter jet training flights and other military activity on an area of frequent and intensive military flight training operations. Krausman et al. (1986) reported that only three of 70 observed responses of mule deer (*Odocoileus hemionus*) to small fixed-wing aircraft overflights at 150 to 500 feet Above Ground Level (AGL) resulted in the deer changing habitats. The authors believed that the deer might have been accustomed to overflights because the study area was near an interstate highway that was followed frequently by aircraft. Krausman et al. (2004) also reported that pronghorn and mule deer do not hear noise from military aircraft as well as humans, which potentially indicates why they appeared not to be disturbed as much as previously thought.

***Mountain Sheep*:** Krausman and Hervert (1983) reported that, of 32 observations of the response of mountain sheep to low-level flights by small fixed-wing aircraft, 60% resulted in no disturbance, 81% in no or "slight" disturbance, and 19% in "great" disturbance. Krausman and Hervert (1983) concluded that flights less than 150 feet AGL could cause mountain sheep to leave an area. Another study (Krausman et al. 1998) found that 14% of bighorn sheep had elevated heart rates that lasted up to 2 minutes after an F-16 flew over at an elevation of 400 feet, but it did not alter the behavior of the penned bighorns. When Weisenberger et al. (1996) evaluated the effects of simulated low altitude jet aircraft noise on desert mule deer (*Odocoileus hemionus crooki*) and mountain sheep (*Ovis canadensis mexicana*), they found that heart rates of the ungulates increased according to the decibel (dB) levels, with lower noise levels prompting lesser increases. When they were elevated, heart rates rapidly returned to pre-disturbance levels suggesting that the animals did not perceive the noise as a threat. Responses to the simulated noise levels were found to decrease with increased exposure.

***Bison*:** Fancy (1982) reported that only two of 59 bison (*Bison bison*) groups showed any visible reaction to small fixed-winged aircraft flying at 200 to 500 feet AGL. The study suggests that bison were relatively tolerant of aircraft overflights.

***Domestic Animals and Small Mammals*:** A number of studies with laboratory animals (*e.g.*, rodents (Borg 1979)) and domestic animals (*e.g.*, sheep (Ames and Arehart 1972)) have shown that these animals can become habituated to noise. Long-term lab studies of small mammals exposed intermittently to high levels of noise demonstrate no changes in longevity. The physiological "fight or flight" response, while marked, does not appear to have any long-term health consequences on small mammals (Air National Guard 1997). Small mammals habituate, although with difficulty, to sound levels greater than 100 db (United States Forest Service 1992).

Although many of the wildlife species discussed above are not present in all areas where FSDM occurs, the information was provided to demonstrate the relative tolerance most wildlife species have of overflights, even those that involve noise at high decibels, such as from military aircraft. In general, the greatest potential for impacts to occur would be expected to exist when overflights were frequent, such as hourly and over many days that could represent “chronic” exposure. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. Even then, many wildlife species become habituated to overflights, which appear to naturally minimize any potential adverse effects where such flights occur on a regular basis.

APHIS-WS would generally only conduct overflights on a relatively small percentage of the land area of the State or Territory involved in FSDM, which indicates that most wildlife would not be exposed to overflights. Additionally, such flights would occur infrequently throughout the year which would further lessen the potential for any adverse effects. Military aircraft produce much louder noise and are flown over certain training areas many more times per year, and yet, were found to have no expected adverse effects on wildlife (Air National Guard 1997). Therefore, it is reasonable to conclude that the aircraft used to shoot feral swine should have far less potential to cause any disturbance to wildlife than military aircraft.

Take of Non-Target Species

While every precaution would be taken to safeguard against taking non-target animals during operational use of methods and techniques for resolving damage and reducing threats caused by feral swine, the use of such methods could result in the incidental lethal removal of some animals. The unintentional capture of removal of wildlife species during FSDM conducted under the proposed action alternative would primarily be associated with the use of snare and live-traps. Those occurrences would be infrequent and should not affect the overall populations of any species under the proposed action. The unintentional removal of non-target species by APHIS-WS during FSDM would be extremely low relative to the population level of the species.

APHIS-WS records the number and type of methods used, target and non-target animals dispersed, relocated, released, and killed for each of its work agreements. These agreements may involve a conflict with one animal, but more commonly they involve actions to resolve conflicts with multiple species. For example, a farmer with a history of conflicts with multiple species (e.g., coyote predation on livestock, crop damage by feral swine, and nuisance raccoon and skunk problems) may establish an agreement with APHIS-WS for assistance in reducing these conflicts over the course of a year when the conflicts occur. Unfortunately, while all non-target take is recorded in the MIS system, the MIS system does not record the intended target species. So, using the example above, the MIS would record that a non-target animal was captured in a snare, but does not provide information on whether the snare was set for coyotes or feral swine. Consequently, review of the non-target animals taken on agreements with feral swine provides an over-estimate of total risk from FSDM activities.

Nationwide, APHIS-WS' FSDM activities (including the annual average take of 30,000 feral swine) and all other wildlife damage management activities conducted under agreements that also include feral swine, resulted in the average annual unintentional mortality of 122 animals (60 hooved mammals, 37 predatory mammals, 23 other mammals, 1 marsupial, and 1 bird). Mortality of these non-target animals was associated with use of snares (88.5%), foothold traps (7.5%), and cage traps (4%). Capture of non-target animals in foothold traps was not likely the result of FSDM because feral swine capture in foothold traps is generally only incidental to other types of damage management. APHIS-WS only rarely sets foothold traps specifically to capture feral swine. An additional 47 non-target animals were captured and released (32 hooved mammals, 7 predatory mammals, 5 other mammals, 2 birds and 1 reptile). The animals were captured and released from cage traps (67%), snares (29%) and foothold traps (4%). None of the non-target animals captured were federally-listed T&E species.

Risks to Migratory Birds and Bald and Golden Eagles

Bald and golden eagles are afforded protection under the MBTA and the BGEPA. Migratory birds also have federal protection under the MBTA. We are providing additional analysis of the risks to these species in this section because of the federal regulations pertaining to their protection and because of the MOU between the FWS and APHIS-WS regarding the conservation of migratory birds (Chapter 1 Section H.11).

Under the Bald and Golden Eagle Protection Act (BGEPA), "take" is defined as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. For regulatory purposes, "disturb" is defined as "to agitate or bother a bald…eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." When a potential risk of unintentional take of eagles is identified, the APHIS-WS program consults with the FWS (Appendix F). As discussed above, impacts to migratory birds and eagles from overflights related to FSDM and other programs are negligible. Coordination with FWS and State, Territorial, and Tribal resource agencies, land management agencies, and landowners would be conducted to identify areas where nesting eagles could be affected. Sensitive areas such as winter roost sites and nesting sites can be avoided, and in some areas it may be possible to adjust time of flight and distance from sensitive areas to avoid disturbance.

Frightening devices intended to disperse feral swine also have the potential to disperse other species, including migratory birds and eagles. The BGEPA prohibits disturbing eagles without authorization from the FWS. According to the FWS, eagles are impacted most when an activity is visible from the eagle nest, and when this activity or similar activities occur regularly near the nest. Therefore, if a nest is identified during FSDM activities, APHIS-WS would implement recommendations for avoiding disturbance at the nest sites as provided in the National Bald Eagle Management Guidelines (FWS 2007). These guidelines include a 330- to 600-foot buffer from an active nest, depending on the visibility and level of activity near the nest. Further, APHIS-WS does not expect that dispersal methods would be employed with sufficient frequency or duration that essential resources would be unavailable for extended periods. Use of frightening devices may be avoided in the vicinity of active eagle nests or during breeding seasons when migratory birds are vulnerable to disturbance. APIHS-WS does not believe the level of impact resulting from FSDM methods and actions would qualify as “disturbance” as defined by the Act.

Capture methods such as snares, foothold traps, and cage/corral traps have the potential to take eagles and migratory birds. During all damage management activities conducted on agreements, which included feral swine, between FY08 through FY12, APHIS-WS lethally removed an average of one non-target migratory bird per year. This is likely an over-estimate of total risk because this number includes birds which were taken on the same properties for other types of damage management (e.g., predation management, bird hazard reduction at airports, crop and property protection). Only one American crow (foothold trap) and 4 black vultures (snares – 3, cage trap - 1) were taken. Both species are abundant and relatively widespread in the United States. APHIS-WS had concluded that this low level of take does not individually or cumulatively to adversely impact populations of these species. Although these are not the only species which could hypothetically be taken during FSDM, the magnitude of impact is typical of what would be expected for any migratory bird that receive additional protections.

APHIS-WS implements numerous measures (see SOPs Chapter 2 Section G) to minimize risks to non-target species, including eagles. Baits used to lure feral swine toward these capture devices would typically be grain-based; meat baits are not used. Per WS Directive 2.455, 30ft spacing is left between animal carcasses and traps to minimize the potential that an eagle preying on a feral swine carcass would be at risk of capture from an adjacent device. Pan tension devices prevent smaller animals from triggering or being captured in such devices. Additionally, the disposition of feral swine carcasses would take into account the potential for attracting eagles. APHIS-WS has learned that in some areas, eagles move along the ground more than might be expected. In these areas, carcasses would be left downwind and crosswind of trap or snare sets to reduce risk of an eagle walking onto a trap or into a snare,. Based on typical eagle behavior, this keeps the food source between the eagle and the sets.

The current FSDM program has not resulted in the capture of eagles. Other APHIS-WS damage management activities use the same methods as the FSDM program to target other species. Nationwide, all APHIS-WS damage management activities that used the same methods as are in used with the FSDM unintentionally captured 26 eagles in the past nine years. Three additional eagles were captured unintentionally by other methods and programs during this time period. Table 4-4 below shows the total number of bald and golden eagles that were unintentionally captured and freed or killed by APHIS-WS from FY05 through FY13. The majority of the eagles were captured in foothold traps. Foothold traps are not commonly used in FSDM; however they are widely used in other programs. Bald eagle populations are stable or increasing nationwide (Sauer et al. 2014). Aerial transect surveys and Breeding Birds Survey data (BBS, Sauer et al. 2014) were used to evaluate golden eagle population data for the U.S. portions of four Western Bird Conservation Regions over the interval of 2006-2010 (Millsap et al. (2013) evaluated golden eagle population trends for the period of 2000 to 2010 (Chapter 3, Section C.1). In general they found slightly declining trends for the southern regions and slightly increasing trends in the northern regions with an overall stable trend for the study area as a whole. However, there are some data indicating that there may be a decline in juvenile golden eagles in the southern Rocky Mountains (FWS 2011). Population trend information takes into account all sources of impacts on the species population. Based on eagle trend information, the average capture of just over three eagles per year nationwide by all APHIS programs with no capture in the FSDM program, and considering that foothold traps are not a primary capture method in FSDM, we can conclude that the risk to individual eagles under the current program is very low, and the cumulative impact of the Current APHIS-WS FSDM Program is not adversely impacting eagle populations.

**Table 4-4.** Non-target Take of Bald and Golden Eagles during APHIS-WS program activities from FY05-FY13.

| Species | Method | Freed | Killed |
|---|---|---|---|
| Bald eagle | Foothold trap | 13 | 4 |
| | Snare | 1 | 0 |
| Golden eagle | Snare | 2 | 5 |
| | Foothold trap | 0 | 1 |

Risks Associated with Ammunition Used for FSDM

Agencies and members of the public have expressed concerns regarding the potential for adverse environmental impacts and risks to human health and safety from the materials used in ammunition. The majority of concerns expressed pertain to the use of lead ammunition and this section correspondingly focuses on risks associated with lead (e.g., Peregrine Fund 2009). However, it should be noted that some of the non-lead materials used in ammunition and lead-free ammunition (arsenic, nickel, copper, zinc, tungsten) are also known to pose environmental risks (Clausen and Korte 2009, EPA 2005*a*, Beyer et al. 2004, Eisler 1998).

Lead is a chemical element that has a variety of uses, including firearms ammunition (shot, bullets, or pellets). Lead ammunition is only one of many sources of lead in the environment (Nebraska Department of Health and Human Services 2013). An average lead pellet contains up to 97% metallic lead, 2% antimony, 0.5% arsenic, 0.5% nickel and jacketed bullets contain up to 90% metallic lead, 9% copper, and 1% zinc (Tanskanen et al. 1991, Scheuhammer and Norris 1995, Scheetz and Rimstidt 2009). The amount of lead varies in ammunition based on the type of firearm and size of the shell, shot, bullet, or pellet. More specifically, the amount of lead varies with the shotgun gauge, the length of the shell used, and the size of the shot and with rifles, pistols, and air guns, the caliber, the type of bullet or pellet, and the grains (weight) of the bullet or pellet used. Risks associated with lead ammunition vary depending upon the type of ammunition used to take the swine. The 00 shot used to remove swine is relatively large (over 8mm diameter). The size of the shot is likely to reduce risks of accidental ingestion by smaller birds seeking grit. Shot is also unlikely to fragment on contact compared with some types of bullets (Cruz-Martinez et al. 2012). Consequently, it may be easier for scavengers to detect and avoid lead than other ammunition. Large shot and bullet fragments are also more likely to be regurgitated (cast) with other undigested food items such as hair, feathers and bone fragments. Rifle bullets vary in the extent to which they break apart upon contact with the animal (frangibilty), but can result in distribution of much smaller fragments in the carcass than shot.

Lead can cause a variety of adverse health effects in people, terrestrial wildlife and aquatic organisms including death (ATSDR 2007, Rattner et al. 2009, Kossnett 2009, Pain 2009, Pokras and Kneeland 2009). More information is available on the impacts of lead on humans than wildlife, particularly in regards to low dose chronic affects (Pokras and Kneeland 2009). However, available information indicates most vertebrate systems respond in a similar fashion to lead (Pokras and Kneeland 2009). Lead affects the neurological, cardiovascular, renal, immune, hematological, reproductive, and developmental systems. Lead can also affect other systems including hepatic, gastrointestinal, musculoskeletal, respiratory, and endocrine systems (EPA 2013c). Effects of lead exposure can have rapid onset and be acute or occur chronically. The primary risks of human exposure to lead from the proposed action would be through the consumption of lead ammunition fragments in feral swine meat. Risks of lead toxicity to humans from ammunition used to remove feral swine can be mitigated through careful preparation of meat. Most state wildlife and/or health agencies provide recommendations on practices to reduce risks from hunting (e.g., NYSDEC 2014). Furthermore, APHIS does not propose to donate feral swine to food charities.

*Impacts of Lead on Terrestrial Species*: Studies focusing on body burdens of lead for mammals that forage in areas contaminated by lead from industrial practices have revealed lead body burdens that have the potential for adverse effects to a variety of small and large mammal species (The Wildlife Society 2008). However, impacts of lead ammunition on populations of scavenging mammals are less clear. Rogers et al. (2011) investigated blood lead levels in large carnivores [grizzly bears , (*Ursus arctos)*; black bears (*Ursus americanus)*; gray wolves (*Canis lupus)*, and mountain lions (*Puma concolor*)] in the Yellowstone ecosystem and whether lead levels varied during hunting season. They did not detect a spike in blood lead levels during the fall hunting season typical of lead ammunition ingestion. However, the authors noted that their data did not preclude exposure to lead in ammunition. Bears, particularly grizzly bears, exhibited elevated blood lead levels, while blood lead levels were low for mountain lions and wolves. Observed patterns of blood lead levels in bears (particularly grizzly bears) may have resulted from a variety of factors including indirect lead exposure from other environmental sources (e.g., indirect exposure to mine tailings), exposure to carcasses of smaller animals (e.g., rodents) taken throughout the year, or differences in the physiology of the bears.

Bird sensitivity to lead from exposure to ammunition such as lead shot,bullets, or bullet fragments has been more extensively studied than in free-ranging mammals. Clinical signs of lead poisoning in birds are observed when blood lead concentrations reach 20 to 50 µg/dL while severe clinical signs are observed at concentrations exceeding 100 µg/dL. Clinical signs of lead poisoning include wing droop, anemia, and weakness in affected birds (The Wildlife Society 2008). The effects of the ingestion of lead shot have been noted in various avian species. Pain et al. (2009), in a review regarding the impacts of lead shot and bullets on terrestrial birds, documented impacts to 33 raptor species and 30 other species including, but not limited to, ground nesting birds, cranes, and upland game birds. Lead impacts from spent ammunition have also been noted in numerous waterfowl species (Trannel and Kimmel 2009). Cruz-Martinez et al. (2012) evaluated data on 1,277 bald eagles admitted to the University of Minnesota Raptor Rehabilitation Center from January 1966 to December 2009. Of the birds admitted 334 were identified as elevated lead cases (322 live, 12 dead). They detected significantly increased odds for elevated lead levels based on season (late fall and early winter), deer hunting rifle zone and age of bird (adult birds). Eagles recovered from hunting zones where rifles were used were at a higher risk of elevated lead levels than eagles from hunting zones where only shotguns were permitted. The difference was attributed to the fact that rifle bullets were more likely to fragment into small pieces that would be more readily ingested by eagles. Similar seasonal patterns in lead exposure corresponding with hunting season have been reported for ravens (Craighead and Bedrosian 2008). An individual lead pellet has been shown to result in lead toxicosis in waterfowl and ground nesting birds. Lethal and sublethal impacts have been noted with the experimental ingestion of 2000 mg (10 pellets of Number 4 lead) of lead in bald eagles (Eisler 1988).

Sublethal impacts to birds are similar to those observed in mammals and other vertebrates. Depending on the dose and exposure time lead can exert deleterious effects on a range of physiological and biochemical functions. Reproductive impacts include effects to the testes, sperm count, egg shell thickness, reduced hatching, as well as numerous embryo-related impacts in various avian test species. Other physiological impacts include decreased red blood cell (RBC) survival and function and altered heme[17] production, immune suppression, and impacts to the central nervous system among other effects. Behavioral effects including depressed locomotion, reduced migratory movement, impaired ability to thermoregulate, and reduced ability to avoid predation have also been noted in a variety of test species (Burger 1995).

Effects from lead shot have been observed in reptiles, especially from chronic exposures. Lance et al. (2006) reported reproductive impacts to captive American alligators (*Alligator mississippiensis*) that were fed nutria containing lead shot. This supports previous work regarding the detection of lead in captive alligators that were related to ingestion of nutria containing lead shot (Camus 1998). Lead blood levels of 280 µg/dL with no apparent lead toxicosis suggests that reptiles may be less sensitive to the effects of lead. Hammerton et al. (2003) made similar observations with the estuarine crocodiles (*Crocodylus porosus*) that had high lead blood levels from consuming prey contaminated with lead ammunition.

A majority of the published literature regarding lead and terrestrial invertebrates focuses on the potential residues that could occur in these organisms in areas that are adjacent to industries related to lead use or production. EPA (2005*b*) established ecological soil screening levels (Eco-SSL) that can be used as an effect threshold based on the available toxicity data. The Eco-SSL in this case was based on the geometric mean of the maximum allowable toxicant concentration (MATC) using the collembolan (*Folsomia candida*) and reproduction as the endpoint. The value estimated from these studies was 1,700 mg/kg dry weight (dw). Soil pH ranged from 4.5 to 6.0 with an organic matter content of 10% in all studies. Other toxicity studies assessing lead effects to

[17] Heme is the red, oxygen-carrying component of hemoglobin.

nematodes and earthworms did not meet the criteria for estimating the Eco-SSL but still provide information regarding lead sensitivity for other soil borne terrestrial invertebrates. In these studies, median lethality values for the nematode (*Caenorhabditis elegans*) ranged from 11.6 to 1,434 mg/kg dw with higher toxicity at lower pH and organic matter values. Median lethality for the earthworm (*Eisenia fetida*) was reported at 3,716 mg/kg dw with reproductive effects noted between 1,629 and 1,940 mg/kg dw.

*Impacts on aquatic organisms*: Although lead from spent ammunition and lost fishing tackle is not readily released into aquatic and terrestrial systems, under some environmental conditions it can slowly dissolve and enter groundwater (USGS 2014). Risks of this type of impact are greatest near some shooting ranges and at heavily hunted sites, particularly those hunted year after year. APHIS-WS FSDM shooting activities are not conducted with the frequency or intensity likely to result in these types of elevated concentrations of lead ammunition in the environment.

The toxicity of lead to aquatic resources such as invertebrates and vertebrates is dependent upon the species tested, endpoint evaluated, and water chemistry. Lead can occur in various forms in aquatic systems based on water and sediment chemistry parameters that can significantly alter the toxicity to non-target species. Water hardness, pH, and temperature are just a few of the water quality parameters that can impact the toxicity of lead to aquatic biota. Lead will also partition to sediment where sediment chemistry parameters such as acid-volatile sulfide levels, organic matter and redox potential all impact the bioavailability and toxicity of lead to aquatic invertebrates and vertebrates. Lead can concentrate in aquatic organisms in particular in filter feeders and algae but has not been reported to bioaccumulate (Eisler 1988).

Aquatic invertebrates appear to be more sensitive to the effects of lead with lethal and sublethal effects noted as low 0.1 µg/L to greater than 16, 000 µg/L. Freshwater cladoceran and amphipods appear to be the more sensitive group of aquatic invertebrates to the effects of lead based on available literature (Eisler 1988, EPA 2006, EPA 2013*c*). Adverse effects to fish occur at concentrations ranging from 3.5 µg/L to 29,000 µg/L with coldwater species such as the rainbow trout (*Salmo gardneri*) being one of the more sensitive species to the effects of lead (Eisler 1988, EPA 2006, EPA 2013*c*). The range of fish sensitivity appears similar to the range of sensitivities for amphibians based on available data (Eisler 1988; EPA 2006; EPA 2013*c*). Median lethality values for amphibians range in the low part per million to greater than 12,500 µg/L in pore water, or interstitial sediment water[18], for the northern leopard frog (*Rana sphenocephala*), while no

[18] Water occupying the spaces between sediment particles. Interstitial water might occupy about 50% (or more) of the volume of a silt-clay sediment. The interstitial water is in contact with sediment surfaces for relatively long periods of time and therefore, may become contaminated due to partitioning of the contaminates from the surrounding sediments. (USEPA 2001).

observable effect concentrations were reported as low as 10.0 µg/L (Eisler 1988, Chen et al. 2006). A variety of sublethal effects have been noted in lead exposures to aquatic vertebrates. Similar to mammals, sublethal lead exposures can impact multiple physiological and biochemical functions in aquatic vertebrates that can lead to reduced reproduction and growth, and the inability to avoid predators and forage for prey items (The Wildlife Society 2008, Eisler 1998).

Exposure and risk to non-target animals would be greatest for wild and domestic animals that consume feral swine carcasses containing lead ammunition from APHIS-WS FSDM actions. There is also the potential for lead exposure to non-target mammals and birds from consumption of lead bullet fragments in the soil. The potential for lead exposure and risk to these types of scavengers would be reduced in situations where carcasses are removed or otherwise rendered inaccessible to scavengers through burial or State, Territory, or Tribally-approved carcass disposal practices. Lead exposure and risk would also be further reduced in cases where the use of lead-free shot can be effectively, safely, and humanely used to remove feral swine.

Exposure and risk of lead to aquatic organisms such as fish and aquatic invertebrates is expected to be negligible. Exposure to aquatic organisms would occur if a lead bullet degrades and enters the water column or partitions to sediment. Both the long half-life of lead ammunition in water, soil, and sediment, combined with the minor amounts of lead that would be used in the program, reduce the potential for significant water exposure from lead discharged directly into aquatic systems or from runoff from soil where lead ammunition may be present (Jorgensen and Willems 1987, EPA 2005*b*). Any dissolved lead that would occur during terrestrial and aquatic degradation would have reduced bioavailability due to site-specific water and soil/sediment conditions that would further reduce the risk to aquatic biota.

The APHIS-WS program has specific ammunition and firearm requirements to maximize performance, safety and humaneness similar to those for other wildlife damage management applications (Caudell et al. 2012). Precision performance of bullets is essential for project efficacy, safety, humaneness (shot placement to result in rapid death) (McPherson 2005, Caudell et al. 2009), and shot placement to preserve tissues for animal health monitoring. Direction of ricochet/passthrough is difficult to predict (Burke and Rowe 1992) and is a safety concern especially at airports, in areas near residences, and for APHIS-WS personnel in aerial shooting teams. Ammunition which conveys it's full energy to the target animal and which results in low or no pass through is needed for reasons of humaneness (instant or near-instant incapacitation) and to reduce safety risks associated with wounded animals traveling from the project site. When removing feral swine, aerial shooting crew members target the space directly behind the feral swine's ear, and the ammunition (primarily shot) must be able to penetrate the "shield" (thick skin) located in this region.

For all programs, APHIS-WS uses lead-free ammunition when practical, effective, and available to mitigate and/or minimize the effects of its use of lead ammunition on the environment, wildlife, and public health and in compliance with Federal or State regulations on the use of lead ammunition. Current challenges associated with lead-free ammunition include that some types of lead-free ammunition are harder than lead ammunition and more likely to ricochet off hard surfaces, increasing the odds of hitting aircraft, personnel, or other unintended targets and presenting unacceptable risks to human safety (APHIS 2012). APHIS-WS has also in tested bismuth ammunition for aerial operations but found the product too frangible for safe and effective use. Increased wounding has been associated with lighter bullets (Aebischer et al. 2014). Lead-free alloys require longer bullets to obtain comparable bullet weights. Terminal performance (the performance of the bullet upon striking the target animal) is, in part, determined by bullet weight. Ballistically, a faster rate of twist is usually necessary to stabilize longer bullets, though individual firearm performance varies. In some calibers (i.e. .22 rimfire and centerfire), accuracy of non-lead ammunition is less than accuracy of lead ammunition in many of the firearms presently in use by WS. While non-lead ammunition is available in many calibers, their suitability and accuracy in all firearms is not universally equal to lead ammunition. Harder lead-free rifle ammunition is more likely to result in "non-frangible bullet pass-through," and failure of the bullet to convey its full energy to the target animal, although similar problems also exist with some types of lead rifle ammunition. In addition to the increased risk of hitting an unintended target, non-frangible bullet pass-through also increases the likelihood that the target animal may not be rapidly or instantly killed by the shot and may be considered less humane (APHIS 2012).

Lead-free ammunition is often more expensive than equivalent ammunition using lead. For example, the Hevi-Shot® discussed below as suitable for use in FSDM, is currently approximately four times as expensive as the lead alternative. Although, the cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns, it is still an issue. Under this alternative, cooperators usually pay operational program costs, and may be unwilling to pay the additional ammunition costs in areas where it is otherwise legal to use lead ammunition. Additionally, under this alternative, individual state programs independently purchase ammunition needed to meet their needs. Although federal purchasing mechanisms exist that help negotiate improved prices for ammunition, some economies of scale which could occur with a large ammunition purchases to meet national program needs are not realized. With small purchases for individual state programs it is also difficult to negotiate special orders for ammunition to meet program needs beyond what would ordinarily be produced by the manufacturer.

APHIS-WS does not use lead ammunition in areas where it is prohibited by law or where prohibited by the landowner/manager (e.g., National Park Service). APHIS-WS uses lead-free shot when using shotguns to remove birds for MBTA permitted activities, including activities in waterfowl production and wintering areas. APHIS-WS also uses lead-free shot during aerial hunting activities when appropriate conditions allow for its safe and effective use, such as locations where problems with ricochets and pass through are not likely to occur. In addition, APHIS-WS uses lead-free rifle ammunition in deer culling activities, except in certain situations where concerns regarding ammunition performance and safety are limiting factors (e.g., shooting from greater distances or situations such as suburban and airport projects where risk of ricochet/pass through is a particular concern). When allowed by regulations and landowners, WS may give preference to lead shot for aerial hunting in rocky terrain where aerial hunting is involved.

APHIS-WS evaluates new lead-free ammunition alternatives as they become available. For FSDM, APHIS-WS has determined that Hevi-Shot® 00 buck, a tungsten, nickel and iron alloy, meets performance requirements. The shot is in limited use for some APHIS-WS applications and no safety concerns with the use of Heavy-Shot® have been identified. Hevi-Shot® does not pose a risk of ricochet during aerial operations even in rocky terrain.

APHIS-WS aims to use the fewest number of shots on targeted animals. Lead ammunition use by APHIS-WS for wildlife damage management activities is minimal compared to lead use at firing ranges and use for hunting, fishing, and shooting sports. APHIS-WS' total FY08 - FY012 total estimated lead use in all program activities including FSDM is approximately 5.87 tons (12,948 lbs) with a yearly average of 1.174 tons (2,588 lbs). The average yearly total amount of lead used in all states by APHIS-WS (FY08-FY12) is small (0.0017%) compared to the U.S. use of lead from ammunition, shot, and bullets based on data from 2011 (USGS 2011). APHIS-WS lead use in individual states varies with the most use in Texas (2,963 lbs) and least use in California, Washington, D.C., Delaware, and New Hampshire (0 lbs). In Texas, APHIS-WS estimated that 2.2 ounces of lead over one square mile (97 mg/acre) was used for wildlife damage management activities between 2006 and 2008 (APHIS-WS 2013).

At the current rate of use, lead ammunition by WS may have the potential to adversely impact individual non-target animals, particularly animals which scavenge carcasses and birds which may inadvertently pick up lead shot when seeking grit for their crop. However, APHIS-WS total program use of lead ammunition, including ammunition used for FSDM is only a small fraction of lead ammunition use by other entities (e.g., hunting, target shooting). APHIS-WS adheres to all applicable laws governing the use of lead ammunition in APHIS-WS activities and landowner/manager desires for lead-free ammunition in their projects. Additionally, the APHIS-WS program is working to shift to lead-free ammunition as new lead-free alternatives that meet WS standards for safety, performance, and humaneness are developed and become reliably available in adequate quantities for program use. Use of lead ammunition by the APHIS program, is anticipated to decrease over time. Consequently, cumulative impacts of APHIS-WS use of lead ammunition would be very low. Given that the majority of lead ammunition is used by non-WS entities, the decisions made by States, Federal regulatory agencies, and land management agencies regarding use of lead ammunition will be the greatest factor affecting the cumulative contribution of lead in the environment.

<u>Beneficial Effects on Non-target Species</u>

As discussed in Chapter 3 Section C, many non-target species could benefit from FSDM, including ground nesting birds, some reptiles, amphibians, and small mammals, if the goal of the FSDM was eradication of feral swine from areas where they had the potential to impact such species. For example, feral swine may consume the eggs of ground-nesting birds if a nest is stumbled upon (Henry 1996, Tolleson et al. 1993). Removing feral swine would benefit the ground-nesting bird by reducing the potential for predation, while other native predators may be benefitted by the reduced competition for a food source. Migratory birds would benefit from reduced habitat damage as a result of a FSDM program. Reducing larval mosquito habitat generated by feral swine rooting could reduce the potential for rapid spread of mosquito-borne avian diseases (USGS 2009). Some species may benefit from using feral swine as carrion. Removal of feral swine has the potential to reduce competition for available resources; reduce predation on the nests of ground-nesting birds and small mammals, reptiles and amphibians; reduce habitat damage and changes in successional stage and composition of plant communities; and reduce risk of disease transmission to native wildlife. APHIS-WS' implementation of a FSDM program may also reduce the unwise or illegal use of methods to reduce feral swine damage. Illegal or unwise activities could result in negative, but unknown, impacts on non-target wildlife.

Under this alternative, APHIS-WS would continue to use an integrated approach to develop the most effective site-specific strategies to resolve and prevent damage to native flora and fauna in cooperation with agency partners, Tribes, and private organizations and individuals. The current program has been effective in reducing local damage, and collaborative efforts in at least one state, Nebraska, have been successful in eliminating a feral swine population. In some States, collaborative efforts have helped to prevent feral swine from becoming established. Unfortunately, despite localized successes, the nationwide range and size of the feral swine population has been increasing and is expected to continue to increase. The increase in population would result in more adverse impacts on native species and their habitats from feral swine.

Conclusions

Methods available to resolve and prevent damage or threats when employed by trained, knowledgeable personnel are highly selective for feral swine, but unintentional take does occur. The established SOPs and other measures and consultation with the FWS and/or NMFS, States, Territories, Tribes, and landowners/managers enable APHIS-WS to minimize impacts. APHIS-WS monitors take of non-target species to ensure that the activities and methodologies used in FSDM do not adversely affect non-target species populations. APHIS-WS would report to the managing agency, as appropriate, any non-target animals lethally removed to ensure removal by APHIS-WS was considered as part of management objectives established for those species. Based on the information above, the Current FSDM Program is not having a significant adverse impact individually or cumulatively on non-target species populations.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

The impacts on non-target species from implementing the Integrated FSDM Program (Alternative 2) would be expected to be similar in nature to the Current FSDM Program (Alternative 1). However, there would be increases in overall FSDM activity under the Integrated FSDM Program, and APHIS-WS' use of some methods (e.g., ground and aerial shooting, cage/corral traps) is likely to increases. Additionally, GonaCon™ injections could be used under this alternative with appropriate approvals and registration.

Research into toxicants (e.g. sodium nitrite) and feed-based reproductive inhibitors is ongoing and would be prioritized under this alternative. APHIS-WS believes that these methods may be important for program delivery in the future and, based on available information, these products could be made available in the future. Operational use of sodium nitrite and feed-based reproductive inhibitors are not proposed under this alternative or any of the other proposed alternatives in this EIS because insufficient information is available at this time for decision-making and planning for programmatic use. Proposals to use these products, if registered for use, would be subject to additional NEPA review when and if the products are developed and registered for field use.

Under this alternative, the concentration of funding will affect the frequency and intensity of application of FSDM methods. The most funding and, consequently, the most intense and frequent FSDM work, will occur in States and Territories with more feral swine, those States and Territories deemed priorities for national feral swine population management, and those States and Territories with strategic local projects. In the short term, impacts to non-target animals may be proportionately greater in these specific areas until program goals are achieved or new priorities are established. On the other hand, the proportion of swine taken through use of aircraft and corral traps is also anticipated to increase under this alternative, because these are the two general strategies that have proven most effective in eradicating or substantially reducing feral swine populations. These are also the two methods with relatively low risks of adverse impacts on non-target species. APHIS-WS would continue to monitor the take of non-target species to ensure program activities or methodologies used in nationally coordinated FSDM program do not adversely affect non-target species populations.

APHIS-WS state programs could potentially work with cooperating agencies, Tribes, private organizations, and individuals in where FSDM had not been conducted previously. Risks to T&E species and eagles may change with when FSDM is provided in these new locations. As these activities are identified, APHIS-WS would consult with the FWS at the State and Territory level to address potential risks (Appendices E and F) in new areas.

<u>GonaCon</u>

Gonadotropin releasing hormone (GnRH), trade name GonaCon™, is a naturally occurring peptide hormone that stimulates sex hormones such as luteinizing hormone (LH) and follicle-stimulating hormone (FSH). LH and FSH regulate gamete and steroid hormone production by the ovaries and testes and are critical in the reproduction of vertebrates. APHIS-WS has developed an immunocontraceptive vaccine, GonaCon™, that when injected into an animal induces the production of antibodies against GnRH, resulting in infertility.

GonaCon™ is preloaded into syringes where it can be injected into target animals by hand or remote delivery. GonaCon™ is currently registered for use in wild or feral equine and white-tailed deer, and shows efficacy against bison and feral swine as well as other mammals where it may eventually be registered for use with the EPA. If registered for use in feral swine, the requirement for injection of individual animals would likely limit the frequency and scope of the product's use to areas were landowners/managers desire population reduction or long-term elimination of feral swine but are opposed to the use of lethal removal.

Risk to non-target fish and wildlife are negligible based on how GnRH is applied, its fate, and label requirements. Risks to humans and non-target organisms that may consume animals injected with GonaCon™ is also negligible, due to the low toxicity of GnRH, its short half-life and its degradation in the gut. GnRH is a protein which is rapidly broken down in the gut. The preloaded syringe eliminates these types of exposures, with the exception of when a remote delivery application misses the intended target or when a syringe is dislodged from an animal. Label requirements to attempt to collect all darts, the very small quantity of GnRH in each syringe, its short half-life, and the infrequent occurrence of a remote delivery that misses the intended target and discharges into the environment, would be expected to result in negligible risk to non-target fish and wildlife.

Risks Associated with Ammunition Used for FSDM

Environmental risks associated with lead ammunition and APHIS-WS ammunition safety, performance and humaneness requirements remain as described for the Current FSDM Program (Alternative 1). Alternative 2 would substantially increase the number of feral swine taken for FSDM and the use of aerial shooting as a tool for FSDM. Unlike the Current FSDM Program, under this alternative APHIS-WS would have additional funding for FSDM and would not have to pass all increased costs of lead-free ammunition to cooperators. The funding provided for an APHIS FSDM program enables APHIS-WS to accelerate ongoing efforts to increase use of lead-free ammunition.

APHIS-WS estimates that roughly 42% of feral swine under the no action alternative over the period of FY 2008-2012 were taken by aerial shooting (Chapter 4 Section B.1.a). As noted (Chapter 2 Section B.1.b) APHIS-WS use of aircraft is anticipated to increase under this alternative. Swine taken by aerial shooting are also among the animals most likely to be left on site (Chapter 2 Section E.11.a). The combination of these factors and the fact that an acceptable lead-free ammunition option has been identified for this purpose (Hevi-Shot® 00 buck; Chapter 4 Section C.2.a above) makes the aerial shooting program a key point for focusing efforts to reduce use of lead ammunition. Consequently, under Alternative 2, APHIS-WS would work to incorporate lead-free ammunition into all aerial shooting activities to the maximum extent practicable within the constraints of performance, availability, and cost through placement of large national orders for ammunition. The APHIS-WS program has determined that 100,000 rounds of Hevi-Shot® ammunition may be obtained for use in aerial operations by negotiating a special manufacturing run by the supplier. This should be sufficient to cover a year's shotgun use for aerial shooting at levels anticipated in the early years of FSDM but may not be sufficient if take with aerial shooting increases, as may occur when the national priorities for operational activities shift to states with higher feral swine populations. Meetings with ammunition manufactures indicate that future availability of sufficient quantities of this shot is uncertain. Until such time as supply reliably meets demand or alternative non-toxic ammunitions are identified, some use of lead ammunition for aerial applications could occur, but would be substantially lower than current levels, even with the increase in the total number of swine removed using aerial shooting.

Because of the overall increase in FSDM activity nationwide, the National FSDM Program would increase the use of lead ammunition for ground shooting. As noted in Chapter 4 Section C.2.a, APHIS-WS is working to reduce use of lead ammunition within the constraints of performance, availability, and cost. Lead-free ammunition would be used in the National FSDM Program where practical and effective or where required by land use policy or state or local laws (SOPs, Section 2.E). Landowners or land managers would continue have the option to limit the use of lead ammunition on their property, and APHIS-WS will work with those entities to determine an acceptable plan, however this may result in additional resources (e.g. time, money) being necessary to achieve management goals. This use of non-toxic ammunition would reduce the amount of lead that would be available to non-target species. Any lead ammunition that may be used could become deposited in soil or water is not expected to result in levels that would pose a threat to non-target populations. The cumulative amount of lead used by APHIS-WS in all wildlife damage management activities, including feral swine, is minor in comparison with the amount of lead used in recreational hunting. States, Federal regulatory agencies, and land management agencies make decisions about whether or not lead can be used and under what circumstances. State and Federal regulations are the greatest factor affecting the cumulative contribution of lead in the environment.

As a federal agency, APHIS takes a cautious approach to ensuring that adverse program effects are minimized by complying not only with applicable federal, state and local laws and regulations for the protection of the environment, but also with landowner/land manager agreements (Directive 2.210). However, because APHIS and others are concerned about the effects of lead in the environment, APHIS is committing to utilize lead-free ammunition options above and beyond those required at national, state, local and landowner levels, within the constraints discussed above. In this way, APHIS would be taking steps to protect non-target animals and the environment well beyond levels set by agencies and regulators with jurisdiction over wildlife management and the use of lead ammunition.

<u>Beneficial Effects on Non-target Species</u>

This alternative provides a balance between the need for site specific damage management and the need to control the national feral swine population. Increased baseline funding and funding for national and strategic local projects would improve the capacity of APHIS-WS state programs and cooperators to conduct local damage management projects to protect non-target species. Although less funding would be provided for baseline capacity and strategic local projects than under the Baseline FSDM Program (Alternative 3), this alternative does provide the national-level improvements in efficacy, outreach, international coordination, and methods development. This alternative is also expected to reduce the national feral swine population and, unlike the Current FSDM Program (Alternative 1), capacity to address local projects is not expected to be exceeded by long-term increases in the size and range of the feral swine population. Therefore, the overall benefits to non-target animals that are negatively affected by feral swine damage is expected to outweigh negative effects under this alternative.

### *c. Alternative 3: Baseline FSDM Program*

Under this alternative, APHIS-WS managers would continue to have access to the range of FSDM methods discussed for the Current FSDM Program (Alternative 1) to develop integrated site-specific FSDM strategies. Baseline resources for FSDM would be distributed to APHIS-WS State programs and would be available for cost-share with other agency, Tribal, and private partners to address local FSDM problems. Funding would be reallocated from research, international coordination and outreach, and education to operational management. Consequently, the potential risks from FSDM methods under this alternative to non-target species, including migratory birds and eagles, could be greater than the Integrated FSDM Program (Alternative 2), because this alternative would see the greatest level of operational activity based on funding availability. APHIS-WS could still employ the use of all methods currently available under the Integrated FSDM Program (Alterative 2) and, given a similar use pattern and measures to minimize risks, impacts on non-target animals would also be expected, in general, to be similar.

In some States, Territories, or Tribal lands, the increase in baseline funding resulting from the elimination of national or strategic local projects may be sufficient for that State/Territory/Tribe to eliminate feral swine and, thus, effects on non-target species would be similar to the Integrated FSDM Program (Alternative 2). It is possible that any effects on non-target species could occur sooner under this alternative than under Alternative 1, as more operational control will be conducted from the start. Under this alternative, States and Territories with moderate to large feral swine populations would likely receive more operational funding than they would receive with the Integrated FSDM Program (Alternative 2). This increased funding would likely be associated with improvements in capacity to provide local benefits to non-target species in the early years of FSDM under this alternative. However, there would be insufficient funds to stabilize and reduce feral swine in all States and Territories with feral swine and there would be no funds reserved to respond to feral swine detections in states believed to be free of feral swine. In these areas, feral swine populations are likely to continue to increase, as would associated adverse impacts on non-target species and their habitats. Overall efficacy of operational efforts may be reduced from that in the Integrated FSDM Program (Alternative 2) because of the lack of research, outreach and education, and international FSDM coordination.

<u>Risks Associated with Ammunition Used for FSDM</u>

Environmental risks associated with lead ammunition and APHIS-WS ammunition safety, performance and humaneness requirements remain as described for the Current FSDM Program (Alternative 1). Like the Integrated APHIS FSDM Program (Alternative 2), this alternative would substantially increase the amount of operational FSDM conducted by APHIS-WS. However, this alternative would result in more operational activity and ammunition use than the Integrated APHIS FSDM Alternative, in part, because program funds allocated to national research, education, disease monitoring or international coordination projects under Alternative 2 would be allocated to operational FSDM under this alternative. The number of swine taken under this Alternative may also be higher than the Integrated APHIS FSDM Program because of the way the resources will be allocated. Under Alternative 2, some funds for operational FSDM will be allocated to achieve the national goal of reducing the size and range of the national feral swine population. Priority would be given to eliminating feral swine populations in states where feral swine populations are recently introduced and/or low. More effort and resources are needed to locate and remove each animal in low feral swine populations than in states with moderate or high populations. Under the Baseline FSDM Program, resources will be allocated to states based on the size of the feral swine population. States with moderate or high feral swine populations would likely receive more funds for FSDM in the early years of the program than under the Integrated APHIS FSDM Program (Alternative 2) and National and Strategic Local Projects Program (Alternative 4).

Like the Integrated APHIS FSDM Program alternative (Alternative 2), the funding provided for an APHIS FSDM program enables APHIS-WS to accelerate ongoing efforts to increase use of lead-free ammunition. APHIS-WS estimates that roughly 42% of feral swine taken under the no action alternative over the period of FY 2008-2012 were removed through the use of aerial shooting (Chapter 4 Section B.1.a). Swine taken by aerial shooting are also among the animals most likely to be left on site (Chapter 2 Section E.11.a). The combination of these factors and the fact that an acceptable lead-free ammunition option has been identified for this purpose (Hevi-Shot® 00 buck; Chapter 4 Section C.2.a above) makes the aerial shooting program a key point for focusing efforts to reduce use of lead ammunition. Consequently, under this Alternative, APHIS-WS would work to incorporate lead-free ammunition into all aerial shooting activities to the maximum extent practicable within the constraints of performance, availability, and cost through placement of large national orders for ammunition. The APHIS-WS program has determined that 100,000 rounds of Hevi-Shot® ammunition may be obtained for use in aerial operations by negotiating a special manufacturing run by the supplier. This would likely be sufficient to cover a year’s shotgun use for aerial shooting at levels anticipated for the Integrated APHIS FSDM Program, but it is unclear whether it is likely to meet needs for the increased take likely to occur under the Baseline FSDM Program. Future availability of a sufficient quantity of the shot is uncertain. Until such time as supply reliably meets demand or alternative non-toxic ammunitions are identified, some use of lead ammunition for aerial applications may occur, but will be substantially lower than current levels, even with the increase in the total number of swine removed using aerial shooting.

Because of the overall increase in FSDM activity nationwide, the Baseline FSDM Program would also increase the use of lead ammunition for ground shooting. As noted in Chapter 4 Section C.2.a, APHIS-WS is working to reduce use of lead ammunition within the constraints of performance, availability, and cost. Use of ammunition for ground shooting and associated impacts would be similar in nature but slightly greater in magnitude than described for the Integrated APHIS FSDM Program (Alternative 2) because of the increase in the number of feral swine likely to be removed under this Alternative. As with Alternatives 2 and 4, under this alternative, APHIS is committing to utilize lead-free ammunition options above and beyond those required at national, state, local and landowner/ land manager levels, within the constraints discussed above. In this way, APHIS would be taking steps to protect non-target animals and the environment well beyond levels set by agencies and regulators with jurisdiction over wildlife management and the use of lead ammunition.

Beneficial Effects on Non-target Species

This alternative provides emphasis on baseline operational capacity. Increased baseline funding would improve the capacity of APHIS-WS state programs and cooperators to conduct local damage management projects to protect non-target species where states were sufficiently funded. National-level improvements that supported long term efficacy would not be realized. Beneficial effects on non-target species would be expected to be greater than the current program, but over time, less than the Integrated FSDM.

***d. Alternative 4: National FSDM and Strategic Local Projects***

Under this alternative, APHIS-WS managers would continue to have access to the range of FSDM methods discussed for the Current FSDM Program (Alternative 1) to develop integrated site-specific FSDM strategies. This alternative is similar to the Integrated FSDM Program (Alternative 2), but involves no baseline funding. All funding under this alternative would be committed to national and strategic local projects. Risks associated with FSDM would be similar to the Integrated FSDM Program (Alternative 2), but more unevenly distributed. States and Territories which are not a priority for national feral swine population management efforts or strategic local funds may receive little or no federal FSDM funding. FSDM activities would still be conducted in these areas with cooperator funds. In the short term, this alternative would be less responsive to requests for local damage management assistance than the Integrated FSDM Program (Alternative 2) and the Baseline FSDM Program (Alternative 3). Under this alternative, it is likely that FSDM with the potential to impact non-target species, including migratory birds and eagles, would be less than that associated with the Integrated FSDM Program (Alternative 2) and similar to the current FSDM program (Alternative 1), if the specific location is not identified as a priority for national of specific local projects. Conversely, areas identified as priorities for National or strategic local projects may temporarily be subject to greater impacts as FSDM methods are focused on those areas until eradication or other goals for that specific location are met. While risks to individual animals may increase slightly, the implementation of SOPs would result no expected adverse effects on populations of non-target species.

Risks Associated with Ammunition Used for FSDM

Environmental risks associated with lead ammunition and APHIS-WS ammunition safety, performance and humaneness requirements remain as described for the Current FSDM Program (Alternative 1). Like the Integrated APHIS FSDM Program (Alternative 2), this alternative would substantially increase the amount of operational FSDM conducted by APHIS-WS. However, this alternative could result in slightly less take of feral swine and associated ammunition use in the early years of the program than the Integrated APHIS FSDM Alternative, or Baseline FSDM Program (Alternative 3). All funds for operational FSDM will be allocated to achieve the national goal of reducing the size and range of the national feral swine population and conducting strategic local projects. All states with feral swine populations will not receive funds for baseline operational capacity to conduct FSDM. Consequently, some states with moderate or large feral swine populations will likely receive less funding for FSDM than under Alternatives 2 and 3 until management objectives are achieved in higher priority states. More effort and resources are needed to locate and remove each animal in low feral swine populations than in states with moderate or high populations, so the total number of animals removed and associated ammunition use is expected to be lower in the initial years of the program than under Alternatives 2 and 3. Long term use of ammunition and associated impacts are likely to be similar to Alternative 2.

As discussed for the Integrated APHIS FSDM Program (Alternative 2) and Baseline FSDM Program (Alternative 3), the funding provided for an APHIS FSDM program enables APHIS-WS to accelerate ongoing efforts to increase use of lead-free ammunition. Under this Alternative, APHIS-WS would work to incorporate lead-free ammunition into all aerial shooting activities to the maximum extent practicable within the constraints of performance, availability, and cost through placement of large national orders for ammunition. APHIS would use Hevi-Shot® in shotguns for aerial shooting under this Alternative, but, as with the Integrated APHIS FSDM Program, supplies may not be sufficient once program activities shift to states with higher feral swine populations. Ammunition manufacturers have indicated that the availability of a sufficient quantity of the shot for increased future use is uncertain. Until such time as supply reliably meets demand or alternative non-toxic ammunitions are identified, some use of lead ammunition for aerial applications may occur, but will be substantially lower than current levels, even with the increase in the total number of swine removed using aerial shooting.

Because of the overall increase in FSDM activity nationwide, this alternative would also increase the use of lead ammunition for ground shooting. As noted in Chapter 4 Section C.2.a, APHIS-WS is working to reduce use of lead ammunition within the constraints of performance, availability, and cost. In the initial years of the program, use of ammunition for ground shooting and associated impacts would be similar in nature but slightly lower in magnitude than described for Alternative 2 and the Baseline FSDM Program (Alternative 3) because of the decrease in the number of feral swine likely to be removed. Long term impacts are likely to be similar to Alternative 2 but still slightly lower in magnitude than the Alternative 3. As with Alternatives 2 and 3, under this alternative, APHIS is committing to utilize lead-free ammunition options above and beyond those required at national, state, local and landowner/ land manager levels, within the constraints discussed above. In this way, APHIS would be taking steps to protect non-target animals and the environment well beyond levels set by agencies and regulators with jurisdiction over wildlife management and the use of lead ammunition.

Beneficial Effects on Non-target Species

Because this alternative may make it possible to achieve national feral swine population objectives more quickly than under other alternatives, overall benefits to non-target species from managing feral swine damage may also be expected more quickly, especially in those states where feral swine populations can be eliminated or substantially reduced.

***e. Alternative 5: Federal FSDM Grant Program***

This alternative would distribute FSDM funding to States, Territories, Tribes, and others through a grant program to meet national FSDM objectives and local needs similar to the Integrated FSDM Program (Alternative 2). APHIS-WS would not be involved in any FSDM except for coordination and supervision of work conducted under grants. Grant recipients would be expected to adhere to the same SOPs as the APHIS-WS when implementing FSDM and research as a condition of the grants. Less federal funding would be available for operational FSDM because more funding would be needed to administer the program. Risks to non-target species from implementation of FSDM should be similar to or slightly less than the Integrated FSDM Program (Alternative 2) assuming grant recipients adhered to APHIS-WS SOPs. If SOPs are not uniformly adhered to by all grant recipients, risks to non-target species would increase.

NWRC would not be involved in research under this alternative. Loss of NWRC research and product registration infrastructure and experience would likely slow the development of new methods such as toxicants and reproductive inhibitors. Benefits and risks associated with these methods would take longer to be realized.

Risks Associated with Ammunition Used for FSDM

Under this alternative, all operational FSDM activities including use of lead would be conducted by recipients of APHIS grants. Environmental risks associated with lead ammunition remain as described for all other alternatives. Grant recipients are expected to use lead-free ammunition when required by federal, state/territorial and local law. In addition, grant recipients would have the same or similar ammunition safety, performance and humaneness requirements as described for the Current FSDM Program (Alternative 1) (Caudell et al. 2012). They would also likely face similar or greater challenges as APHIS with cost and availability of lead-free ammunition.

Allocation of resources for FSDM (e.g., National, baseline and strategic local projects) would be similar to the Integrated APHIS FSDM Program (Alternative 2). However, because of increased administrative costs, less total FSDM would be conducted under this alternative than under Alternative 2, so fewer feral swine are likely to be taken per year and less ammunition used. Grant recipients would be expected to adhere to the same SOPs as the APHIS-WS when implementing FSDM and research as a condition of the grants. Risks to non-target species from lead ammunition used for FSDM should be similar to or slightly less than the National FSDM Program (Alternative 2) assuming grant recipients adhered to APHIS-WS SOPs. If SOPs are not uniformly adhered to by all grant recipients, risks to non-target species would increase. Risks may also increase, depending the on the ability of grant recipients to obtain lead-free ammunition. APHIS-WS would not be arranging for national purchases of lead-free shot for aerial applications. Any cost benefits realized by placing one large ammunition order may not be realized, although it is possible that grant recipients (e.g., states and territories) may work together to place similar orders. As with the Current FSDM Program (Alternative 1), with smaller purchases, it is also difficult to negotiate special orders for ammunition to meet program needs beyond what would ordinarily be produced by the manufacturer.

Beneficial Effects on Non-target Species

Overall, because less funding would equate to less operational FSDM, benefits from feral swine removal would probably be lower than under the Integrated FSDM Program (Alternatives 2), the Baseline FSDM Program (Alternative 3), and National FSDM and Strategic Local Projects (Alternative 4). The ability to reduce negative effects caused by feral swine to other wildlife species and their habitats, including T&E species, would be variable and would be based upon the skills and abilities of the entity implementing damage management actions under this alternative.

### 3. Impact on Soils, Vegetation, and Water Quality

This section discusses the potential effects of FSDM on soils, vegetation and water quality. Effects on plants and critical habitats protected under the ESA are considered separately under Section 4.C.1.

#### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

FSDM actions within the Current FSDM Program that have the potential to disturb soils and vegetation include vehicle use, minor digging associated with setting traps, digging post holes to install permanent fencing, and the use of corral traps. Leaving carcasses on-site, composting carcasses, and excavation for on-site carcass burial would have the greatest potential to impact soils and could also adversely affect water quality. The use of lead ammunition could potentially contaminate soil and water. No other methods are currently proposed that would have the potential to adversely affect water quality.

All feral swine eventually die even if there is no FSDM and their bodies remain above ground until they decompose or are consumed by scavengers. At present, leaving carcasses to decompose on site is the most commonly used carcass disposal method for APHIS-WS. Carcasses are only left on site after consultation with the landowner/manager to ensure that the landowner does not have another intended purpose for the swine (e.g., personal use as food) and that there are no regulatory, environmental, human health, aesthetic, or other public concerns that would preclude use of this method. Carcasses of swine removed through aerial shooting are usually left in place which results in them being scattered across the property. Carcasses of swine removed by ground shooting or those animals shot after being caught in drop nets, or cage or corral traps would be grouped in one area. When these capture methods are used, APHIS-WS scatters the carcasses in the area surrounding the trap site to minimize any potential environmental risks associated with a concentration of carcasses in one spot. Decomposing carcasses would provide food for scavengers and some soil nutrients. Vegetation and soil characteristic around the carcasses would remain and would help to reduce risks that material from decomposing carcasses could wash away and contaminate local water supplies. Carcasses would not be left in or near public water supplies, or isolated water sources although some carcasses may be left near large wetland or swamp habitats if that is the primary habitat used by the swine. Impacts on soil, vegetation, and water quality from leaving carcasses to decompose on-site would be similar to the status quo in which feral swine would die and decompose or be preyed upon by predators and scavengers. This method has reduced risk of adverse impacts associated with soil disturbance caused by burial.

Landfill burial is used in some states. APHIS-WS only takes feral swine carcasses to those landfills approved to accept animal carcasses. Because landfills are regulated, permitted, and monitored by both the EPA and the States for environmental protections, this option is considered to have negligible adverse environmental impacts and will not be analyzed further.

Prior to conducting FSDM, APHIS-WS coordinates with agency partners, Tribes and landowners/managers to identify sensitive areas (e.g., areas with fragile soil types, sensitive vegetation, and water resources) to ensure that FSDM actions do not create unnecessary problems. Vehicles, including Off-road Vehicles (ORVs), stay on designated roads or trails in most cases and do not drive off road in protected sensitive areas. If access to sensitive areas is necessary, efforts are made to use methods and schedule removals to minimize risks to soils and water. Most capture equipment, including cage traps and corral traps, is set in previously disturbed areas, including agricultural lands or other areas where feral swine have already caused damage. Setting traps and snares is negligible in terms of soil disturbance.

Fence construction and carcass burial is typically conducted by the landowner or land manager. APHIS-WS may provide technical assistance for these activities. Surface soil disturbance and soil loss from installing permanent fence posts would be limited to the immediate area of the posts, and soil loss up to a depth of 3 feet would be a long-term effect, although minor in scope. In some limited cases, APHIS-WS may bury carcasses if requested or as required by law. Currently, APHIS-WS buries feral swine carcasses in relatively few States including Alabama, Arkansas, Florida, and New York. In most states with large feral swine populations, including Texas, California, Hawaii, New Mexico, and Oklahoma, APHIS-WS does not bury carcasses on-site.

The size of on-site burial pits (or trenches or graves) is based largely on the number of animals killed in one location. States regulate livestock burial but only Arkansas considers feral swine to be livestock (Appendix D, Table 1). Where livestock burial is concerned, pit size and depth also depend upon applicable state laws or local ordinances or policies which can dictate minimum or maximum depth and amount of cover material (soil) that must be placed over the carcass(es). Other conditions such as soil type, depth to bedrock, and climate can influence the volume of the soil that must be excavated. Under the Current FSDM Program, individual burial sites generally accommodate few individual feral swine in shallow graves, and those graves have been on previously disturbed soils.

Various authors report different excavation volumes needed to bury five hogs (commercially raised swine) ranging from 1.2 to 3 cubic yards (Engel 2004). On average, feral swine would tend to be smaller than commercial hogs, in part, because dispatched feral swine include all life stages including very small pigs. Thus, lower volumes of soil would be needed to bury five average feral swine.

Sounders[19] commonly have 9-10 swine, but, depending upon environmental conditions such as droughts, may have as many as 40 or 50 animals (Chapter 3 Section A.3.a). The number of swine to be disposed of at one location would depend, in part, on the size of the sounder and on the method used to remove the swine. Feral swine removed using aerial shooting or hunting with dogs are dispersed over the landscape, so relatively few individuals need to be buried in a given site. In contrast, when using corral traps and drop nets, managers strive to capture all of the sounders at one time.

When APHIS-WS is directly involved in on-site burial, measures are taken to conserve soil and protect vegetation and water quality. These measures can include removing and replacing topsoil, mounding sites to allow for settling to avoid ponding, and, as needed, recommending revegetation to landowners or land managers. Larger, existing burial trenches are sometimes excavated by livestock managers for routine livestock carcass disposal programs. In this case, State and local regulations dictate site restrictions. These restrictions can include minimum cover depth, depth to high water table, and distances to wetlands, floodplains, wells, ponds, and other water sources.

Where on-site feral swine carcass burial is used for disposal and state and local regulations address feral swine, APHIS-WS follows these rules or recommends that landowners do so as well. However, as noted above, only one state currently regulates feral swine as livestock. In other states, there is often uncertainty as to which set of disposal regulations (livestock, wildlife, or something else) should apply. The lack of regulatory clarity is related to the legal status of feral swine, which varies from state to state. Feral swine status ranges from wildlife, to game, to exotic species, to livestock, and no status. Status can even change from private to public lands or otherwise depend on the location, ownership/use and management of feral swine. Appendix E, Table 1 shows the variations in legal status of feral swine among States and Territories. Because current carcass disposal needs have been relatively low based on limited operational programs and based on other viable options, this issue has not been problematic. However, the lack of feral swine carcass disposal rules in some states highlights an emerging issue which will be discussed in the next section, under the Integrated FSDM Program (Alterative 2). Because many States, Territories, and Tribes lack comprehensive regulatory controls for feral swine burial, burial site selection, size, depth and cover, any feral swine burial would be planned with local resource authorities to reduce the risk of water and soil contamination. Burial site remediation would include soil conservation measures to protect soils, vegetation, and water quality.

If chemical euthanasia is used, APHIS-WS personnel would comply with procedures outlined in the APHIS-WS Field Operations Manual for Use of

[19] A sounder is a group of swine, usually adult females with their sub-adult and juvenile offspring.

Immobilizing and Euthanizing Drugs (June 2006) and APHIS-WS Directive 2.430, Controlled Chemical Immobilization and Euthanizing Agents. Feral swine euthanized with drugs that may pose secondary hazards to scavengers must be disposed of according to Federal, State, county, and local regulations, and drug label instructions, or lacking such guidelines, by deep burial, incineration, or at a landfill approved for such disposal.

On-farm composting is a method for dealing with routine animal mortalities that is receiving increasing attention and use by the livestock industry. Properly conducted, temperatures in compost piles reach high enough temperatures to kill disease organisms such as salmonella. Environmental concerns associated with composting include runoff from compost piles and contamination of soil beneath piles. Most state departments of agriculture provide training and regulations for safe and effective use of this method including location and construction of compost sites and proper use of resulting material to minimize risk of runoff from fields to nearby waterways. APHIS-WS would not establish new compost sites for its projects, but it may take advantage of compost piles established by producers to dispose of carcasses from their livestock operations. Conducted in accordance with state regulations and guidance, composting is not anticipated to adversely impact soils and water.

Soil disturbance, including mixing, trampling and compaction in corral traps, could be expected from concentrating feral swine, as might occur in corral traps. However, corral traps would most often be placed in areas where swine have already damaged soils and vegetation. Posts for corral traps are typically temporary and do not require digging. Other physical attributes within the corral, such as soil layering, clay/sand/loam content, water, and organic matter content are not expected to cause long-term impacts to the area where the trap is placed. After APHIS-WS removes corral traps, the landowner or land management agency may attempt to remediate the area if necessary to return it to its previous use. Some soils may recover more successfully than others with amendments or plantings, and vegetation may return on its own or be replanted. Fragile, thin, soils found in arid and semi-arid locations are not likely to recover easily. Corral traps are placed in areas that have already experienced feral swine damage; therefore, soil productivity would be expected to improve over time after feral swine are removed.

Baits used to attract feral swine to capture sites and equipment would be carefully selected with land managers input when necessary to help ensure that undesirable plant species are not introduced in the course of FSDM activities. Depending on the nature of the site, cleaning vehicles and footwear of specialists when entering and leaving sites may be needed to prevent introduction of invasive species. Removal of feral swine would eliminate their damaging effects on vegetation from: direct browsing and rooting, spreading weed seeds in their feces, and disturbing soils, all of which can facilitate invasions of introduced plant species that can out-compete native plants.

Water erosion and sedimentation would not likely be a concern in most places where corral traps are set because they would be placed in areas with little to no slope, they are temporary, and most often, they would be located in wooded locations or areas that otherwise have sufficient vegetative cover to buffer any possible effects. Trap location is always coordinated with land managers or owners.

APHIS-WS often uses non-lead ammunition where practical and effective or where required by land use policy or state or local laws (SOPs, Section 2.E). Any of the potential exposure pathways are expected to result in minimal loading of lead in aquatic environments because large numbers of shot or bullets, and any fragments, would not be anticipated to be deposited directly in those types of environments for most APHIS-WS activities. In addition, the environmental fate of lead ammunition is such that bioavailability would be very low even under environmental conditions that would promote degradation and bioavailability. Lead from spent ammunition that would occur in runoff from soil would also be extremely low. Degradation rates for lead pellets and bullets to more soluble or bioavailable forms in soil are variable depending on soil type, and other site-specific factors; however, half-lives for pellets have been shown to range from 40 to 70 years (Jorgensen and Willems 1987). In addition the amount of lead that becomes soluble in soil is usually very small (0.1-2.0%) (USEPA 2005). Efforts to identify and acquire non lead ammunition would be coordinated at the national level.

The Current FSDM Program would not provide national coordination or increase in scope of FSDM. Therefore, the direct and indirect impacts from feral swine on soils, vegetation, and water quality (Section 3.D.1) would continue or increase at current baseline rates along with anticipated growth in the feral swine populations. Damage from feral swine is likely to spread to new locations where no feral swine currently exist. The negative effects on soils, vegetation, and water quality from feral swine trampling, browsing, rooting, and wallowing would be expected to increase as feral swine populations continue to expand and increase under the Current FSDM Program. Where populations of feral swine are successfully removed locally, related additional feral swine damages would be interrupted or halted, but relief would only be temporary if new swine are released at the site or swine immigrate from surrounding populations.

Section 2.E describes the SOPs that are used to minimize or avoid negative impacts on soils and vegetation. Overall, the benefit to soils, vegetation, and water quality from feral swine removal is expected to outweigh any minor negative effects.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

This alternative would increase operations using the same methods as the Current FSDM Program (Alternative 1). Capture methods would have similar negligible effects on soils, vegetation, and water quality because the same SOPs would be applied to minimize risks. As the number of feral swine that would be killed under this alternative increases, the disposition of carcasses would become a greater issue.

Of the carcass disposal methods available under the Integrated FSDM Program, on-site burial, leaving on site, and composting could potentially adversely affect soils, vegetation and/or water quality. In some circumstances, APHIS-WS would employ the use of on-site burial, either directly or indirectly, via land owners or land managers, as discussed under the Current FSDM Program (Alternative 1). As with the Current FSDM Program (Alternative 1), in most instances, APHIS-WS could use composting systems already established by producers. However, the number of carcasses generated in one location could justify the construction of on-farm compost piles to dispose of feral swine. All on-farm composting would be conducted in accordance with State and local regulations or guidance. Risks of soil and water contamination may be minimized through the use of liners for the compost area, but otherwise, the risks would be similar to or less than the risks associated with carcass burial.

Landfill burial would also continue to be an option for carcass disposal. This option requires moving swine to the landfill, however, that may be prohibited in some states because of the diseases which feral swine may carry. Because landfills are regulated, permitted, and monitored by both the EPA and the states for environmental protections, the impacts of using landfills as a disposal method on soils, vegetation, and water quality will not be analyzed further.

Traditionally, routine on-site carcass burial has been considered to have minimal environmental impact when used sparingly by relatively small livestock operations. However, concerns have grown about the potential that ground and surface water could be adversely affected by pathogen and chemical contamination via soil leaching (CAST 2008, Engel 2004). In comprehensive assessments, Engel et al. (2004) and CAST (2008) reviewed these concerns and found that environmental risks from burial included contamination of soil and shallow groundwater with nitrogen, chloride, and coliform bacteria. Ground and surface water contamination from the chemical byproducts of carcass decay have been identified as the primary risk factor from carcass burial (McDaniel 1991, Crane 1997). Gwyther (2011) found no studies linking adverse effects of routine livestock burial to adverse effects on ground or drinking water, but studies evaluating the effects of livestock burial have focused more on mass emergency burials than routine burials and even those studies are relatively few in number (Freedman and Fleming 2003).

Like the Current FSDM Program (Alternative 1), on-site feral swine carcass burial, if used, would typically involve the disposal of relatively few individual animals; however, two scenarios may become more likely under this alternative and could create greater risks of indirect and cumulative impacts on soil and water quality. These scenarios would occur if feral swine carcasses were added to existing trench sites used for routine livestock burial (cumulative effects, Section H), or if land or resource managers of larger properties with high numbers of feral swine decided to transfer and concentrate feral swine carcasses in a common burial site (indirect impact).

Decomposition is influenced by different factors including the number of animals in the burial site, soil properties, and climate influences. When used as a disposal method, on-site burials under the Integrated FSDM Program may typically accommodate about 1,000 pounds of carcasses, or the equivalent weight of five 200 pound adult feral swine (considering that whole sounders would be targeted, which averages more animals, but includes young). Glanville (2000) reported that livestock carcass degradation releases about 20 pounds of nitrogen into the soil for every 1,000 pounds of carcass. Extrapolating this number up can create nitrogen loads in excess of rates used agronomically and which could contaminate groundwater, potentially affect well water, or create problems for fish in groundwater dependent streams, especially if carcasses are buried below the root zone where nitrogen cannot be utilized by plants. Feral swine pathogens could also be a concern. Many factors affect the movement of pathogens through soil to groundwater, including soil type, permeability, water table depth, and rainfall, but soil processes and microbial predation can also significantly reduce the amount of pathogens eventually reaching underlying groundwaters (Beal et al. 2005). The addition of hydrated lime to the base of burial trenches or pits has been shown to reduce the survival and transfer of pathogens in the soil (Sanchez et al. 2008).

Routine on-site livestock burial is addressed by State and local authorities. Thus, if feral swine carcasses were added to existing trenches used for routine livestock carcasses disposal, they would be regulated by States, and sometimes counties, and those entities would evaluate/regulate the environmental effects. However, feral swine are not regulated as livestock in most states, and livestock burial requirements often don’t apply. State laws and local guidance often differ on required livestock burial practices. Trench site selection, depth of burial, allowable maximum numbers of animals per pit, total weight per acre per year, required depth of cover material, depth of pit floor above groundwater, and minimum distance to water sources such as floodplains, wetlands, wells, and ponds are some factors that can be specified in local regulations and policies. APHIS-WS would not typically be in a position to select sites for trench excavation, but because State and local laws can change over time, local planning must include consultation with State/Territorial/Tribal officials and wildlife, environmental quality, and/or agriculture officials (e.g. State Veterinarian) to ensure that local guidelines on carcass burial are considered and potential contamination concerns are mitigated. APHIS-WS' local environmental reviews (e.g. Environmental Assessments or documented Categorical Exclusions, Section 3.E.) may be issued to implement decisions made from this EIS and would include more local analysis of impacts on soil, vegetation, and water quality where on-site burial is a proposed disposal option.

Some states limit the number of livestock carcasses that may be buried in one site or per acre. For example, Virginia's Department of Environmental Quality issued a policy ranking on-site burial as a last resort of disposal options, and restricting burial to 2,000 pounds per acre per year (Golden 2009). Iowa has set limits on the number of livestock carcasses that can be buried to 44 swine per acre per year (Glanville 2008). Despite the fact that these rules are not directed at feral swine, this information should be considered when planning larger feral swine burials since the intent of the state and local regulations and policies is to protect environmental quality.

A key factor germane to the discussion of the Integrated FSDM Program effects on soil and water quality is that feral swine are dispersed and not concentrated in large numbers like typical livestock operations. Barring human-caused mortality, such as damage management and hunter harvest, if feral swine do not fall to predation, they naturally die in place on the landscape. Burial reduces or eliminates the potential for scavenging as a method for cycling back into the food chain. Still, typical on-site feral swine carcass burial would involve few animals in shallow graves placed away from water sources and would not be expected to increase water contamination risks substantially over those occurring from naturally fallen swine. Larger numbers of feral swine, such as more than one sounder, or especially large sounders buried in one site would require additional evaluation at the local level to consider ground and surface water risks. Because a variety of carcass disposal options are available to APHIS-WS and partner agencies depending on local rules, burial would not be expected to be a widely selected option in any case.

Soil conservation should also be considered with on-site carcass burial. Soil disturbance can be calculated based in part on the number of swine that would be buried. For on-site burial, unless carcasses would be transported to a common pit, the greatest number of feral swine carcasses that would be placed in a pit or trench under the Integrated FSDM Program would likely be from corral trapping and euthanization of whole sounders. A site selected to bury an average sized sounder of 9 or 10 individuals (Mapston 2010, Graves 1984, Nogueria et al. 2007) would likely fall within the 1.2 to 3 cubic yard range reported by different authors in Kastner et al. (2004) for burying 5 hogs. Compared to commercial hogs, a sounder would include a number of younger and smaller animals. Thus, soil volumes needed for burial could be estimated at the lower end of the range. More individual feral swine could be removed at some sites which would increase excavation requirements. Soil volume would also depend on its depth, distance to bedrock, and other properties. Finally, where state laws specified, soil volume could also vary in the amount of cover material (depth of soil from carcass to natural ground level). Similar to the Current FSDM Program (Alternative 1), if APHIS-WS uses on-site burial as a direct disposal method, or if it is used by cooperators, APHIS would use or recommend management practices that minimize adverse effects on soils and vegetation including removing and replacing topsoil, mounding soil to allow for settling to avoid ponding, and as needed, installing erosion control structures (e.g. berms to divert surface water), and recommending revegetation. These measures would further reduce the potential for adverse impacts on soil, vegetation, and water quality.

The Integrated FSDM Program would increase the use of lead ammunition for shooting in the short term. As noted in Section 4.C.2, APHIS-WS is working to reduce use of lead ammunition within the constraints of performance, availability, and cost. Non-lead ammunition would be used in the Integrated FSDM Program where practical and effective, or where required by land use policy or state or local laws (SOPs, Section 2.E). This would reduce the amount of lead that could occur in the environment from widespread use. As with the Current FSDM Program (Alternative 1), any lead ammunition that may be present and could occur in soil or water is not expected to result in levels that could impair water quality or result in lead levels beyond the range of baseline soil concentrations that have been reported in the United States. Lead deposited in either of these environments would be subject to slow degradation over time and based on site-specific conditions would have variable bioavailability further reducing the potential for any impact on soil and water.

The general lack of regulatory controls over on-site feral swine carcass burial, and the soil and water contamination risks from potential larger on-site burials, is a concern that should be resolved with local resource experts. On-site burial is expected to be used infrequently and burial of more than one sounder would probably be more infrequent still. Other carcass disposal methods would have minimal adverse effects on soils, vegetation, and water quality with use of SOPs. By effectively removing and reducing feral swine populations (Section 4.B.1), the Integrated FSDM Program would be likely to provide widespread and long term benefits to soils, vegetation and water quality.

Based on the review of the ability of the alternatives to achieve management goals and objectives, this alternative would be the most effective in reducing feral swine damage while balancing the need for local damage management and a nationally-coordinated population control effort. Long-term reduction of feral swine damage to soil, water and vegetation as presented in Chapter 3 Section C.1.a would be greatest under this alternative.

In conclusion, this alternative provides a balance between the need for baseline FSDM capacity to address local feral swine damage to vegetation, soils, and water and the need to stabilize and reduce the national feral swine population so that problems do not increase in scope and magnitude over the long-term. Adverse effects on soils, water, and vegetation under this alternative would be similar in nature to the Current FSDM Program (Alternative 1) because the same methods would be used; however, impacts would be greater in scope because of the increase in FSDM.

### c. *Alternative 3: Baseline FSDM Program*

Alternative 3 provides baseline funding only and would initially result in the greatest level of operational activity of all the alternatives. The number of swine removed for a given amount of effort is likely to be highest in areas with high feral swine populations. Consequently, this alternative may generate the highest number of feral swine carcasses of any of the alternatives because it allocates money based on the size of the feral swine populations. The discussion of potential effects on soils, vegetation, and water would be similar to the Integrated FSDM Program (Alternative 1). However there would be increased potential for negative effects on soils, vegetation, and water quality in the short term if burial were used more frequently, or if larger burial sites were used. Lower program efficacy, as compared to Integrated FSDM Program (Alternative 2), would require that efforts to manage feral swine may continue on a longer timeframe. SOPs to protect soils, vegetation, and water quality would be similar to the Integrated FSDM Program (Alternative 2) and would be likely to reduce impacts to negligible levels.

This alternative would benefit soils, vegetation, and water quality well above the Current FSDM Program (Alternative 1) since substantially more feral swine removals and local population elimination would occur. Compared with the Integrated FSDM Program (Alternative 2), it would more immediately benefit soils, vegetation and water quality with all emphasis in field operations at the local level. However, in the long term, without the support of national level projects to enhance efficacy and without strategic local level projects to target complete local populations, this alternative is likely to be less effective in eliminating feral swine and reducing local damages than the Integrated FSDM Program (Alternative 2). Therefore, cumulative long-term benefit to soils, vegetation, and water quality would be expected to be lower than for the Integrated FSDM Program (Alternative 2).

### d. Alternative 4: National FSDM and Strategic Local Projects

This alternative would not provide baseline capacity funding for states with feral swine. Consequently, some State/Territory/Tribal lands with high feral swine populations, and/or which do not intend to eradicate feral swine populations (Figs.

2-2, 4-4; Appendix D, Table 2), may not receive any federal funding for FSDM. In those cases, effects on soils, vegetation, and water quality would be similar to the Current FSDM Program (Alternative 1). Where states receive funding for strategic local projects and work to achieve national feral swine management goals, focused, intensive operations would be implemented to eradicate feral swine. In general, more time and effort is needed per animal to remove swine from a small population and/or the last few swine from a population. Total swine taken per year under this alternative may be similar to or lower than the Integrated FSDM Program (Alternative 2) and the Baseline FSDM Program (Alternative 3), but would still be greater than for the Current FSDM Program (Alternative 1). Risks to soils, vegetation, and water and associated SOPs would be similar to those described for the Integrated FSDM Program (Alternative 2). Based on these SOPs, risks to soils, water, and vegetation are expected to be low.

This alternative would have less capacity to address local feral swine damage in the short term. Damage to soils, water, and vegetation in states which are not identified as priorities for national feral swine population reduction or national and strategic local projects may increase until such time as resources are freed to address damage in their area. However, because this alternative would apply more funding to national projects (e.g. research, national-level education, and outreach programs and materials) than any other alternative, it would likely provide beneficial effects based on long-term efficiency and efficacy in stabilizing and reducing the national feral swine population. More States would be cleared of feral swine and associated damage in a shorter period of time under this alternative than under the other alternatives.

***e. Alternative 5: Federal FSDM Grant Program***

APHIS-WS would not directly affect soils, vegetation, or water quality under this alternative since it would not implement FSDM operations. The FSDM Grant Program would require that a substantial amount of funding be committed to oversight, compliance, and monitoring. Because the FSDM Grant Program would require that grant recipients implement SOPs to reduce adverse effects on soils, vegetation, and water quality, the success of the measures would be related to the degree that grant recipients followed protocol established for resource protections.

Overall, because less funding would equate to less operational FSDM, benefits to soils, vegetation, and water quality from feral swine removal would probably be lower than under the Integrated FSDM Program (Alternatives 2), the Baseline FSDM Program (Alternative 3), and National FSDM and Strategic Local Projects (Alternative 4). Whether or not this alternative might provide similar benefits than the Current FSDM Program (Alternative 1) would depend greatly on the efficiency of the grant recipients or their agents who deliver FSDM services. This alternative is not likely to provide as much potential benefit to soils, vegetation, and water quality that are harmed by feral swine because fewer feral swine would likely be eradicated or removed in both the near and long term.

## 4. Impact on Odor/Air Quality

### *a. Alternative 1 - Current APHIS FSDM Program (No Action Alternative)*

The Current FSDM Program utilizes a variety of methods for the disposal of feral swine carcasses. The primary carcass disposal method used by the Current FSDM Program is leaving the carcasses on site. Proximity to residential locations and recreational sites is taken into consideration when determining an appropriate carcass disposal method. The methods of carcass disposal would depend on, and be influenced by, regulatory requirements, site accessibility/feasibility, individual site circumstances, land owner or land manager preference, and operational cost/cost effectiveness.

All carcasses would be disposed of in accordance with APHIS-WS Directive 2.515, Disposal of Wildlife Carcasses. As such, all carcasses of feral swine removed by APHIS-WS would be disposed of in a manner that is consistent with applicable Federal, State, Territorial, Tribal, county, and local regulations. APHIS-WS personnel would make a reasonable effort to retrieve and dispose of carcasses when leaving them on-site is not environmentally preferred or included in agreements. In many situations, where limited numbers of feral swine would be taken over a large geographic region with limited access, carcasses would be left on-site. All disposals would be made in a manner that demonstrates APHIS-WS' recognition of the public's sensitivity to the viewing of wildlife carcasses.

As discussed in Chapter 2 Section 11, death of animals is a natural part of any ecosystem. Allowing carcasses to remain on-site offers several advantages in comparison to other disposal methods. These include lower disposal costs, providing a food base for scavengers, and lowering the potential for disease transmission to off-site locations. Feral swine carcasses would be allowed to remain on-site with landowner permission and in compliance with all Federal, State, Territorial, tribal, and local laws and regulations. APHIS-WS expects the impacts on air quality form this methods of disposal to be low, given limited human habitation. APHIS-WS expects that leaving carcasses to decompose on site will have short-term aesthetic impacts on air quality. However, impacts on people are likely to be minimal because this method would not be used in areas where people are likely to encounter the carcasses and associated odor. Particular effort will be made to avoid using this method in areas where carcasses are likely to be encountered by recreationists.

In areas with close human habitation and/or where odor from decomposing carcasses left on-site may be problematic (e.g., feral swine removed from golf courses), carcasses may be disposed of by other approved methods.

Other approved methods with the potential to create odor and affect air quality include landfill disposal, composting, incineration, chemical digesters, alkaline hydrolysis and rendering. Of these methods, only landfill burial and incineration have been used under the current program, and APHIS has used these options infrequently. The remaining methods have not been used, or are not expected to be used widely based on their limitations (Appendix H). State and Federal regulations on landfill burial, incineration, chemical digesters and alkaline hydrolysis are expected to address air quality and odor issues to acceptable standards.

On-site and landfill burial

On-site (or trench burial) involves excavating a trough into the earth and placing carcasses into the trench and covering with excavated material (backfill). On-farm burial of routine mortalities typically is done using the trench method, which involves excavating a narrow and relatively shallow trench with a backhoe, placing a single layer of carcasses in the trench, and covering them with excavated soil (CAST 2008). Traditionally, burial is considered to be a convenient method for routine mortality disposal with minimal environmental impact when used sparingly by relatively small livestock operations (CAST 2008). In some circumstances, APHIS-WS would employ the use of on-site burial for feral swine carcasses where necessary, feasible, and practical.

In the aftermath of the 2001 UK FMD outbreak, the UK Environmental Agency (2001 in NABCC 2004) published an interim assessment of the environmental impact of the outbreak. The most notable environmental pressures associated with burial included odor from mass burial sites and landfills and burial of items such as machinery and building materials during the cleansing and disinfection process. The interim environmental impact assessment concluded that no significant negative effects on air quality had occurred, and no evidence on public health was observed.

Modern landfills are required to meet design and operating standards outlined in the federal Subtitle D regulations (Subpart 257 and 258, Title 40, Federal Code of Regulations). Key features of landfill design include composite liners, leachate[20] containment systems, and gas collection systems (NABCC 2004). The purpose of a landfill is to effectively contain waste such that the components of waste and/or the by-products of decomposition do not escape into the environment. The primary by-products resulting from decomposition of waste in the landfill are leachate and landfill gas.

[20] Leachate is a liquid that percolates through a substance, and may contain some of the material or contaminates of the material through which is passed.

The anaerobic decomposition of organic materials in a landfill generates a combination of gases, collectively called landfill gases. Landfill gas is composed of approximately 50% methane and 50% carbon dioxide (NABCC 2004). Passive gas control systems (relying on natural pressure and convection mechanisms to vent gas to the atmosphere) are becoming less common due to the unpredictable nature of gas movement in landfills. Active systems employ gas recovery wells or trenches and vacuum pumps to control migration of landfill gas, and may even allow capture of gas for energy recovery.

In 2001, monitoring of air quality near a mass burial site in Lockerbie, Scotland was performed to determine the presence of compounds that may be injurious to human health (Glasgow Scientific Services Colston Laboratory 2001 in NABCC 2004). The monitoring regime included total volatile organic compounds, flammable and other bulk gases, individual volatile organic compounds, and hydrogen sulfide. It was concluded that although odor causing compounds were identified, the concentration of contaminants were within air quality guidelines and, although a source of annoyance, were not expected to result in adverse health effects. Because feral swine are distributed over the landscape and not concentrated as with livestock operations, mass burials of feral swine are not expected and odor effects would be minor in comparison.

<u>Composting</u>

On-farm composting has evolved more recently as a disposal method for domestic swine mortality (CAST 2008). APHIS-WS' use of composting would involve pre-established compost sites. APHIS-WS would not construct new compost sites to dispose of feral swine. Composting is not expected to be a widely used disposal method.

Carcass composting is a natural biological decomposition process that takes place in the presence of oxygen. Under optimal conditions, during the first phase of composting, the temperature of the compost pile increases, the organic materials break down into relatively small compounds, soft tissue decomposes, and bones soften partially. In the second phase, the remaining materials (mainly bones) break down fully and the compost turns to a consistent dark brown or black soil or "humus" with a musty odor containing primarily non-pathogenic bacteria and plant nutrients (NABCC 2004).

Disposal of animal carcasses may generate different environmental and health hazards. Various agricultural agencies (Alberta Agriculture, Food, and Rural Development 2002; AUSVETPLAN 1996 in NABCC 2004) indicated that improper carcass disposal procedures might cause serious environmental and public health problems, including odor nuisance resulting from the anaerobic breakdown of proteins by bacteria, which could reduce the quality of life and decrease property values of nearby residences.

Among other site selection criteria, composting facilities should be located downwind of nearby residences to minimize potential odors or dust being carried to neighboring residences by prevailing winds. Choosing an appropriate composting site would help prevent negative reactions from neighbors and decrease nuisance problems. Fermentation and oxidation of carcasses during composting produces unpleasant gases ($CO_2$, $NH_3$, $H2_S$, etc.) and odors associated with the liquid or solid biomass. Different methods have been suggested to neutralize the unpleasant effects of these gases. Some researchers suggest that wood ash be used as an absorption medium. Rosenfeld and Henry (2001 in NABCC 2004) studied the use of activated carbon and wood ash to neutralize odors produced from wastewater, compost, and biosolids. A properly covered compost pile that is biodegrading carcasses under anaerobic conditions should generate little to no odor (NABCC 2004).

A good composting operation would not generate an offensive odor (NABCC 2004), and there has been significant progress on biological and chemical deodorization of compost gases. Currently, odor absorption units use multistage chemical scrubbing to reduce offensive odors (Haug 1993 in NABCC 2004). Biofilters are widely used in many compost facilities.

Rendering

Rendering has historically been defined as separation of fat from animal tissues by the application of heat. Rendering of animal carcasses involves conversion of carcasses into three end products: carcass meal (proteinaceous solids), melted fat (tallow), and water by using mechanical processes (e.g., grinding, mixing, pressing, decanting, and separating), thermal processes (e.g., cooking, evaporating, and drying) and sometimes chemical processes (e.g., solvent extraction) (NABCC 2004).

Because carcasses are typically not refrigerated for preservation prior to rendering, they begin to putrefy and give rise to odorants. Due to this, rendering is often perceived by the public as unpleasant and smelly (NABCC 2004). A significant environmental issue for the rendering industry is controlling various odors generated during pre-rendering, rendering, and post-rendering processes.

Considerable progress has been achieved in manufacturing very high efficiency odor neutralizing units (NABCC 2004)). Odor control equipment systems include condensers, scrubbers, afterburners, and bio-filters. Strong odors are generated during cooking and drying processes, and are carried in the steam emitted by rendering plants (NABCC 2004). Condenser units wash the cooking steam with cold water and then liquefy all condensable material. This process reduces the temperature of the noncombustible substances to around 35-40$^{o}$C (95-104$^{o}$F) and transfers the heat (Fernando 1995 in NABCC 2004). The cooling water removes up to 90% of odors and recovers heat energy from the cooking stream. Scrubbers are used to absorb chemical compounds. A condenser followed by a two-stage scrubbing unit can provide up to a 99% odor reduction (NABCC 2004). Afterburners are used to burn gases released from the exhaust of a scrubber.

According to Fernando (1995 in NABCC 2004), a test on the composition of the gases released from the exhaust of the afterburner showed that it was completely free of hydrogen sulphide, mercaptans, and amines. Condensers, scrubbers, afterburners, and bio-filters can be used in a combined system or individually.

A satisfactory odor abatement system in a rendering facility would reduce odorants to levels below those that can be detected by humans (Fernando 1995 in NABCC 2004). Rendering processes can be carried out without being a public nuisance as long as fresh or stabilized raw materials are used and appropriate odor control devices are employed for plant emissions (NABCC 2004). Advantages associated with rendering for disposal of routine domestic swine mortality could also apply to the disposal of feral swine carcasses are that rendering is closely regulated to be environmentally safe, the end product is considered biosecure, and in some instances, rendering allows for process cost recovery (CAST 2008).

Rendering is not expected to be used widely by APHIS-WS due to the limitations of this option (Appendix H).

Incineration

Open burning would be avoided due to potential fire hazards except when this method is required by regulations and can be conducted safely (APHIS-WS Directive 2.515). APHIS-WS Directive 2.515 allows for carcasses to be incinerated in approved facilities that comply with Federal, State, and local regulations. Open-air carcass burning includes burning carcasses in open fields, on combustible heaps called pyres, and with other burning techniques that are unassisted by incineration equipment (NABCC 2004). Generally, a state permit is required prior to initiating an open-air burn and open-air burning is not allowed in every state (APHIS 2003, p. 2707 in NABCC 2004). Fixed-facility incinerators include small on-farm incinerators, small and large incineration facilities, crematoria, and power plant incinerators. Fixed-facility incineration is wholly contained and, usually, highly controlled. Fixed-facility incinerators are typically fueled by diesel, natural gas, or propane. In some states, regulations stipulate that permitted mortality incineration equipment must contain a secondary burn chamber or “afterburner” to decrease particulate matter (i.e., “fly ash”) and other emissions (CAST 2008). Newer designs of fixed-facility incinerators are fitted with afterburner chambers designed to completely burn hydrocarbon gases and particulate matter exiting from the main combustion chamber (Rosenhaft 1974 in NABCC 2004). Many incinerators are fitted with afterburners that further reduce emissions by burning the smoke exiting the primary incineration chambers (Walawender 2003 in NABCC 2004).

Air-curtain incineration involves large-capacity fans driven by diesel engines which deliver high-velocity air either down a metal refractory box or a burn pit (trench), thereby creating a turbulent environment in which incineration is greatly accelerated (Ford 1994 in NABCC 2004) and is a relatively new technology for carcass disposal (Brglez 2003, Ellis 2001 in NABCC 2004). Air-curtain incinerators have been used for carcass disposal in the wake of natural disasters in the United States (Ellis 2001 in NABCC 2004). Air curtain incinerators have been used in Colorado and Montana to dispose of animals that were infected with chronic wasting disease (APHIS 2003 in NABCC 2004). Air-curtain incinerators have met regulatory approval in the U.S. and around the world (Ford 2003 in NABCC 2004). If placed far from residential centers and the general public, they are generally not nuisances (APHIS 2002 in NABCC 2004).

Open-air burning cannot be recommended for routine on-farm mortality disposal for a number of reasons, most notably the potential to generate excess pollutants in the form of smoke and odor, the possibility of creating a public nuisance, the risk of causing unintended fires, and the violation of regulatory restrictions (CAST 2008). Most state regulatory agencies do not permit open-air burning for routine disposal of livestock mortality (Henry, Wills, and Bitney 2001; Morrow, Ferket, and Middelton 2000 in CAST 2008).

It is generally accepted that open-air burning pollutes. The nature of open-air burning emissions hinges on many factors including fuel type. The fear of dioxin and smoke inhalation, along with generally poor public perception of pyres, eventually compelled the discontinuation of the use of mass burn sites in the UK (Scudamore et al. 2002 in NABCC 2004). However, pollution levels never exceeded levels in other (urban) parts of the UK, did not violate air quality regulations, and were deemed to have not unduly affected the public health (Cumbria Foot and Mouth Disease Inquiry Panel 2002, Hankin and McRae 2001, McDonald 2001, UK Department of Health 2001a and 2001b in NABCC 2004).

In contrast to open-air burning, properly operated fixed-facility and air-curtain incineration pose fewer pollution concerns. During the UK 2001 foot and mouth disease outbreak, air-curtain incinerators offered conspicuous environmental advantages over open-air burning (Ford 2003 in NABCC 2004). Air-curtain technology in general has been shown to cause little pollution (Ford 2003 in NABCC 2004). If operated in accordance with best practices and existing environmental regulations, both small and large afterburner-equipped incinerators should not pose serious problems for the environment. In addition, APHIS-WS does not expect to use this method frequently.

<u>Anaerobic Digestion</u>

Anaerobic digestion, sometimes referred to as biomethanization and biodigestion, is a method of carcass disposal available to APHIS-WS under this alternative, however there are few of these facilitates available. Anaerobic digestion involves the transformation of organic matter by a mixed culture bacterial ecosystem without oxygen. It is a natural process that produces a gas principally composed of methane and carbon dioxide.

There are several environmental advantages to anaerobic digestion. Among other benefits, the process reduces greenhouse gas problems. While the public generally accepts biodigesters, they should still be located away from residential areas to minimize odor problems (NABCC 2004). APHIS-WS would not be expected to use digesters commonly. Digesting facilities are regulated by Federal and State entities, so APHIS-WS use of such facilities is not expected to have any negative impacts in the environment.

Alkaline Hydrolysis

Alkaline hydrolysis uses sodium hydroxide or potassium hydroxide to catalyze the hydrolysis of biological material into a sterile aqueous solution consisting of small peptides, amino acids, sugars, and soaps and is another method available to but not currently used by APHIS-WS for FSDM. The process releases no emissions into the atmosphere and results in only minor odor production (NABCC 2004). The end product is a sterile, coffee-colored, alkaline solution with a soap-like odor that can be released into a sanitary sewer in accordance with local and federal guidelines regarding pH and temperature (Kaye 2003 in NABCC 2004).

Lack of access to incineration, rendering, alkaline hydrolysis and anaerobic digestion facilities is a current limitation with regard to feral swine carcass disposal. Based on the information above, the Current FSDM Program has a negligible effect on air quality.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

Implementing an Integrated FSDM Program (Alternative 2) is not expected to add appreciatively to the effects of feral swine carcass disposal on odor issues or air quality. Feral swine carcasses would increase under this alternative; however, based on the fact that feral swine are dispersed across the landscape, disposal needs would similarly be dispersed and not typically concentrated as is generally the case with livestock. The majority of feral swine carcasses would be left in place to be quickly scavenged and decompose. In addition, by working with land owners and land managers to ensure that carcass management does not create an odor nuisance, and by complying with Federal, State, Territorial, or Tribal regulations and statues as well as APHIS-WS Directive 2.515, the impacts on odor and air quality would remain negligible under the Integrated FSDM Program.

#### *c. Alternative 3: Baseline FSDM Program*

Initially, this alternative could result in the removal of more feral swine and subsequently more feral swine carcasses requiring disposal. However, because feral swine are dispersed across the landscape, disposal needs would similarly be dispersed and not typically concentrated. The majority of feral swine carcasses would be left in place to be quickly scavenged and decompose. In addition, by working with land owners and land managers to ensure that carcass management does not create an odor nuisance, and by complying with APHIS-WS Directive 2.515 and Federal, State, Territorial, and Tribal regulations and statues pertaining to the disposal of carcasses, APHIS-WS' impact on odor and air quality would be negligible under this alternative.

#### *d. Alternative 4: National FSDM and Strategic Local Projects*

Under this alternative, the removal of feral swine, and thus the need for carcass disposal would likely be less than under the Integrated FSDM Program (Alternative 2) if a specific location has not been identified as a priority for national of specific local projects. Conversely, those sites identified as priorities may temporarily see higher levels of feral swine removal and be subject to greater carcass disposal needs. As with the Integrated FSDM Program (Alternative 2), impacts of this alternative on odor and air quality issues would be negligible.

#### *e. Alternative 5: Federal FSDM Grant Program*

Grant recipients would be expected to follow the same protocol for carcass disposal as discussed under the other alternatives. Overall, fewer feral swine would be removed; however, the potential for odor and air quality effects would be related to the degree with which grant recipients or their agents complied with these conditions. Odor and air quality issues are expected to be negligible.

### 5. Impact on Recreation

This section discusses the potential effects of the FSDM alternatives on recreation including effects on sport hunting feral swine, hunting other game species, the public's aesthetic enjoyment of the natural environment, and operational FSDM disturbance to recreationists.

#### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

<u>Effects on Feral Swine Hunting</u>

The Current FSDM Program likely has a limited or low level effect on the public's opportunities to hunt feral swine. Under the Current FSDM Program, impacts of APHIS-WS actions on hunting opportunities vary depending upon the size of the feral swine population, available funding, and State, Territorial, and Tribal management regulations and management objectives for the species. State and Territorial management objectives and regulations for feral swine hunting are listed in Appendix D, Tables 2 and 3, respectively. In states with well-established moderate or high feral swine populations and established hunting traditions, APHIS-WS feral swine removals are typically focused on resolving damages on individual properties or in specific damage situations where hunting is restricted (e.g. protecting private cropland or an endangered species on public land where hunting is not allowed). Alabama, California, Florida, Guam, Puerto Rico (Mona Island), and Hawaii manage feral swine as a game mammal. APHIS-WS reports all feral swine lethally removed to game management officials in these States and Territories. This helps to ensure that APHIS-WS removals are incorporated into population and harvest management objectives. Under the Current FSDM Program, the magnitude of lethal removal combined with other known sources of mortality, is low when compared with the known populations (where populations or trends are estimated); and all sources of mortality are unlikely to limit populations in these areas (USDA 2014a, 2014b, 2013a, 2008). For all of these reasons, APHIS-WS removal of feral swine has likely had no effect on hunter harvest opportunities in states that manage feral swine as game mammals. Impacts on hunting opportunities would be similar in almost all of those states that do not manage feral swine as a game mammal, but have well established feral swine populations and allow hunting (Appendix D, Table 2).

In States, Territories, and Tribal lands with low or newly established feral swine populations, APHIS-WS and cooperating agency cumulative actions have the potential to impact hunting opportunities. Actual impact depends on the management objective of the State, Territory, or Tribe and whether existing regulations permit swine hunting. The greatest single factor influencing feral swine hunting opportunities are state/territorial/tribal regulations. In States, Territories, and Tribal lands where the goal is to maintain a small population for recreational or cultural purposes, APHIS-WS actions and impacts on the recreational opportunities would be conducted in much the same manner as described above for states with moderate or high populations. However, in areas where the management objective is to eradicate or substantially reduce the population, the collective action of APHIS-WS and all other entities may result in the eradication of feral swine from all or a substantial portion of a State, Territory, or Tribal lands. Impact on feral swine hunting opportunities would depend on whether or not feral swine hunting is allowed in the area. If hunting is not permitted, eradication of the population would not change the environmental baseline conditions. Elimination of feral swine at the State, Territory, or Tribal level in areas which allow hunting has the potential to adversely impact local feral swine hunting opportunities. Hunters could seek feral swine hunting opportunities in others states that still have free-ranging feral swine or use enclosed hunting preserves where permitted, but there would likely be substantial increase in the travel time and expense involved.

In areas that do not currently have feral swine populations, APHIS-WS may also work with partner agencies and Tribes to prevent feral swine and associated hunting opportunities from becoming established. APHIS-WS actions in these areas would help to prevent the establishment of hunting opportunities. However, many of the areas that do not have feral swine have, or are working on, regulations to prevent swine from being used or managed as a game species.

As noted in Section B.1 above, the amount of area affected by feral swine nationwide has generally been increasing, although there have been some successes at reducing or eliminating feral swine populations (e.g., Nebraska, Illinois, New York). There are many other obstacles to controlling feral swine. Inadequate funding, inadequate regulatory mechanisms, partnerships, outreach and education, and access problems on private property are cited as reasons that State and territorial management objectives have not been met (Table 3). Consequently, limitations of the Current FSDM Program have resulted in an increase in feral swine hunting opportunities. The APHIS-WS New Mexico pilot project program is the only program under the Current FSDM Program that is likely aggressive enough to substantially reduce a well-established and abundant feral swine population. Feral swine hunting is allowed in New Mexico, but the State does not manage feral swine as a game animal. Instead, the State's goal is eradication. While eradication is not likely to be achieved under current program efforts, recreational hunters and others who benefit from feral swine could be affected by a reduction in feral swine populations.

Ironically, interest in feral swine hunting is believed to be a significant factor contributing to the relatively rapid spread of feral swine in recent years. Some states, including New Mexico, have allowed swine hunting (Appendix D) in an effort to help with population control, but this has led to widespread intentional releases to improve local hunting opportunities (Bevins et al. 2014, Anderson and Yoest 2012, Zivin et al. 2000, Cox 1999, Waithman et al. 1999, Mayer and Brisbin 1991).

Inadequate funding, regulatory mechanisms, partnerships, outreach and education, and access problems on private property were cited by States and Territories in an informal 2013 APHIS-WS questionnaire as reasons that FSDM management objectives, whether they are broad scale or more localized eradication, have not been met. Executive Order (EO) 13443- Facilitation of Hunting Heritage and Wildlife Conservation directs Federal agencies that have activities that have a measurable effect on outdoor recreation and wildlife management, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. It directs Federal agencies to cooperate with states to conserve hunting opportunities. Under current regulatory and management conditions, feral swine populations have increased in number and distribution. For these reasons, there is likely to remain an abundant and growing population of feral swine that can be hunted under the Current FSDM Program. In addition, APHIS-WS has no effect on State laws governing hunting of feral swine.

Effects on Hunting Other Game Animals

Feral swine can adversely impact the abundance and distribution of other game species. Effects on other game animals were described in Chapter 3, Sections C.1 and 3.F and the effects of program alternatives on wildlife were compared in Chapter 4 Section C.2. Feral swine removal from habitats that support game species, such as wild turkey, quail, and white-tailed deer, would benefit such species and would be in accordance with the direction provided in EO 13443 - Facilitation of Hunting Heritage and Wildlife Conservation. The Current FSDM Program is not comprehensive enough to have more than localized benefits where local populations of feral swine are removed. As long as feral swine populations are not completely removed, predation, competition, habitat degradation, and displacement threats can be expected to return and/or continue (Bach and Conner 2013). Negative effects on individual game animals from FSDM methods are negligible and do not affect populations.

Effects on the Aesthetic Enjoyment of the Natural Environment

As noted in Chapter 3, Section 4. B, perceptions of aesthetic values vary among individuals depending upon their values and experiences. The animal one person sees as a recreational benefit may be perceived as a deterrent to recreation by another. For example, some people may enjoy viewing feral swine or feeding them at parks or picnic areas. However, feral swine have a reputation for aggressive behavior. Feral swine that habituate to developed public recreation sites such as campgrounds or trail heads may be removed as a precaution to protect human safety.

When feral swine are in parks, other public lands, or any place where people enjoy nature, they reduce the aesthetic benefits of non-consumptive recreation (e.g. hiking, photographing nature, and wildlife watching) because they destroy native vegetation, soils, water quality, and both game and nongame wildlife. Feral swine damage can also adversely impact the historic character and aesthetic nature of a site by damaging property and vegetation (e.g., disturbing civil war grave sites, damage to historic landscapes and living history sites).

Existence values are a component of aesthetic values. For some individuals, the knowledge that native ecosystems and recreational areas are being damaged by an invasive species is a negative impact on their aesthetic values. For others who value the rights and existence of individual animals regardless of their status or impacts, removal of feral swine would be an adverse impact on their aesthetic values.

Localized FSDM actions may be effective in alleviating these negative effects temporarily or within limited areas where removal is successful. The Current FSDM Program is not comprehensive enough to have more than localized benefits in most areas, many of which may be temporary. Similar to the effects on hunting other game animals, as long as feral swine populations are not completely removed, damage can be expected to continue or return in the absence of ongoing management efforts.

In States, Territories, and Tribal lands where feral swine populations are abundant and growing even when local populations are removed, feral swine are still likely to be enjoyed as “watchable wildlife” in other areas of the state. As noted in Chapter 3, it is unlikely that wildlife photographers or observers seek feral swine as a primary recreational goal. In those states where eradication is a goal, the positive aesthetic values of feral swine would be eliminated. The loss of the positive aesthetic value of feral swine would be traded for the removal of an invasive species and resultant benefit to the natural environment, including native wildlife and plant species that may be suppressed or displaced by the presence of feral swine.

<u>Disturbance to Recreationists from FSDM</u>

Some members of the public may be concerned that FSDM activities could conflict with their recreational enjoyment of an area where control actions occur. Some areas could potentially be closed while FSDM actions are being conducted for the protection of human safety. Aerial shooting involving low flying fixed wing aircraft or helicopters has the potential to temporarily disturb some recreationists due to the noise and visibility of the aircraft. Aircraft would also be used for surveillance and to provide logistical support for ground based swine removal operations.

Aircraft disturbance would be temporary and of short duration. Aerial FSDM is highly effective and efficient and would be visible and audible, but for a shorter period of time as compared with other more labor intensive methods. Aircraft are commonly used to access remote locations where few people would potentially be disturbed; however, they can also be used in areas where more people would see and hear them. When APHIS-WS flies over public lands, planning and coordination with the land management agency identifies recreational issues. APHIS-WS also complies with Federal Aviation Administration (FAA) regulations pertaining to overflights (500 foot buffer). Bigger buffers may be used at the request of the applicable landowner/manager (e.g., for NPS lands) as appropriate. Because Federal, State, Territorial, and Tribal land managers are consulted in planning, potential effects on the public in high use recreational areas or other sensitive areas can be avoided.

Traps, snares, and shooting may also cause some individuals to be concerned if they are aware of FSDM operations in the area. Some individuals would likely encounter warning signs posted at prominent locations that indicate that equipment has been set in the area. These concerns are likely to be primarily for human and pet safety. Human safety and potential non target animal effects are discussed in Chapter 4 Sections C.7 and C.2, respectively, which conclude that the risks to humans and pets from FSDM methods are low.

Current FSDM Program activities have limited, and short-term effects on outdoor recreational use of public lands. Land and resource management agencies typically minimize closures and recreation is allowed to continue during FSDM. However short-term closures of limited extent could occur during aerial and ground hunting operations which would temporarily exclude public access and recreation activities to protect public safety and minimize disturbance. Closures are typically minimal in high use recreation areas, particularly during weekends and holidays. FSDM work is typically scheduled to coincide with times of low use to avoid closures or minimize their impacts. Noise from helicopters and fixed wing aircraft, gunshots, and dogs may be heard by the recreating public during project implementation.

Corral traps set for feral swine are generally placed in locations not visible from recreation facilities, roads, or trails and are not expected to negatively affect outdoor recreation. Short spans of temporary fencing used to enhance removal efforts would be placed away from recreation facilities and out of public view wherever possible. A 500-foot buffer around open developed recreation facilities would be established for aerial hunting operations to further reduce noise impacts.

As feral swine become more abundant and occupy new habitats, they have become established on protected lands, Federal wilderness areas and other important natural areas used for recreation. Parks, Wilderness, and Wilderness Study Areas, are examples of protected natural areas that are managed by federal agencies, States, Territories, Tribes, and local agencies for their important natural, scientific, and recreational values. APHIS-WS coordinates all proposed FSDM work with land management agencies to avoid conflicts with land use objectives including recreational uses. For example, high-use recreational areas are designated on maps associated with work plans to help APHIS-WS avoid unintentional adverse impacts on recreation. High-use hunting areas are also delineated by the land management agency so that APHIS-WS can remove FSDM equipment before the hunting season. High use recreational areas, like other sensitive areas, are identified at a site specific level in APHIS-WS work plans, maps, or as new damage situations arise.

APHIS-WS has Memoranda of Understanding (MOUs) with both BLM and USFS which outline processes for FSDM coordination and cooperation. For Wilderness Study Areas (lands that are being considered for Wilderness designations), APHIS-WS conforms to Revisions and Clarifications to H-8550-I, Interim Management Policy for Lands Under Wilderness Review (March 19, 2002 memorandum (No. 2004-140) from BLM and FS Acting Director to BLM and FS Washington and Field Office Officials). APHIS-WS FSDM actions have no effect on wilderness characteristics other than temporary disturbance as discussed above. Because of the limited and temporary nature of FSDM in any specific area, and because APHIS-WS coordinates all planning with appropriate federal, state, territorial, and local land managers prior to working in any protected areas, land use conflicts are avoided and land use plans are followed, which helps to ensure that APHIS-WS has negligible negative impact on any special management area uses, including recreation.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

<u>Effects on Feral Swine Hunting</u>

Feral swine that are subject to heavy damage control or hunting pressure become increasingly difficult to locate and remove, in part because low densities make them more difficult to find. Attempted control also alters the behavior of feral swine, making them more wary of control methods. Behavioral changes also include adapting activity patterns from afternoon to nighttime under heavy hunting pressure (Mansfield 1978). When lower densities and behavioral change are combined with access challenges such as extensive tracts of private lands or complex land ownership patterns, or heavy vegetation or rugged or remote terrain, hunting opportunities for feral swine are likely to be adversely affected.

California, Florida, Guam, and Hawaii would likely continue to manage feral swine as a regulated game mammal and, therefore, hunting opportunities are not likely to be adversely affected for the same reasons discussed under the Current FSDM Program (Alternative 1). Alabama regulates feral swine as a game animal, but has a long term eradication goal. In the states where eradication is a State management objective (Table 4-2 and Appendix D Table 2), the Integrated FSDM Program would work with partner agencies to either eliminate or substantially control feral swine populations (Figure 2). In many of these states, feral swine hunting is allowed, and therefore, recreational hunting opportunities would likely be reduced. Shooting feral swine is sometimes incidental to hunting for other species. Because hunting feral swine in many states is allowed year round, as compared with regulated game hunting (which has restricted seasons (Bach and Conner 2013)), the ability to hunt this “big game” animal year round would be eliminated in some states or reduced in others.

As discussed under the Current FSDM Program (Alternative 1), many states implemented open hunting on feral swine as a method to control populations. While this has not gone far to eliminate populations, it has created more hunting opportunities, and these are the very hunting opportunities that would be most negatively affected. The degree of effect on opportunities for hunting feral swine would be negatively correlated to the relative efficacy and success of the Integrated FSDM Program where state objectives are elimination. Any effects on opportunities for hunting feral swine, whether regulated or not, would be determined by State, Territorial, and Tribal regulations, management plans, and policies and objectives. Like the Current FSDM Program (Alternative 1), the single greatest influence over feral swine hunting remains State, Territorial, and Tribal regulations and management objectives (Appendix D). APHIS would have increased ability to provide technical assistance to States, Tribes, and Territories that are developing regulations on feral swine which may impact long term opportunities for feral swine hunting. By conducting FSDM activities in accordance with State, Territorial, and Tribal management objectives for the species, including maintenance of feral swine as a game species, where desired, APHIS actions are consistent with the direction of EO 13443- Facilitation of Hunting Heritage and Wildlife Conservation. Although feral swine hunting opportunities may be diminished in some areas, these reductions would be consistent with state management objectives and would be balanced by beneficial impacts on hunting opportunities for other species (see Effects on Hunting Other Game Animals below).

Research and baseline capacity under this alternative would increase the ability of APHIS programs to provide technical assistance and data for State, Territorial, and Tribal officials, and local agencies and legislators who are developing regulations on feral swine. APHIS review of existing federal regulations may identify areas for improvement in existing regulations or potential new regulations which can facilitate effective feral swine management. Education and outreach under this alternative would include information and data to discourage hunters from moving feral swine. Discussions on the effects on feral swine hunting businesses can be found in Section 4.C.9.

Effects on Hunting Other Game Animals

The Integrated FSDM Program would alleviate the direct and indirect negative effects of feral swine on game animals in those states where feral swine can be eliminated. It would be more beneficial than the Current FSDM Program (Alternative 1) in those states where feral swine populations are substantially reduced or eliminated in localized areas. Feral swine removal from habitats that support other game species would benefit such species, assist the States, Territories, and Tribes with meeting game management objectives, and indirectly benefit hunters consistent with the direction provided in EO 13443 - Facilitation of Hunting Heritage and Wildlife Conservation

Negative effects on individual game animals from the use of FSDM management methods would be negligible as discussed under Section 4.C.3, Impacts on Non-target Animals.

Feral Swine and the Aesthetic Enjoyment of the Natural Environment

When feral swine are present or have caused destruction of natural areas, their removal would benefit those areas. Agencies or individuals involved in restoration efforts would be able to restore areas without immediate threats of feral swine returning. Compared with the Current FSDM Program (Alternative 1), the Integrated FSDM Program would be likely to provide benefits where swine are eliminated from States, or populations are substantially reduced or locally eliminated.

Viewing feral swine would still occur to some extent in those states where populations are well established, where feral swine are managed as a game species, or where eradication is not feasible or desired. People who enjoy the intrinsic value of feral swine would know that they still exist in the environment. Obviously, because feral swine would be eliminated in some states and population size and distribution would diminish, the interest of people who enjoy seeing feral swine or knowing they exist in nature would be adversely affected. The intrinsic value of feral swine needs to be weighed against the enormous damages they inflict on other aspects of the environment, including the aesthetic quality of the environment.

Similar to the Current FSDM Program (Alternative 1), FSDM activities may reduce the aesthetic enjoyment of natural areas temporarily as discussed below under "Disturbance to Recreationists from FSDM.". Compared with the Current FSDM Program (Alternative 1), carcass disposal may be more evident to members of the public because more individual animals would be killed. Odor may be a temporary factor in some places if large numbers of feral swine are left to decompose naturally, although care would be taken to avoid leaving carcasses in areas commonly used by recreationists. The loss of the positive aesthetic value of feral swine would be traded for the removal of an invasive species and resultant benefit to the natural environment, including native wildlife and plant species that may be suppressed or displaced by the presence of feral swine.

Disturbance to Recreationists from FSDM

Compared with the Current FSDM Program (Alternative 1), control actions would increase substantially under the Integrated FSDM Program, which would increase the potential for disturbance in more areas. Because aerial shooting is particularly effective and efficient under certain conditions when compared with other management methods, the recreating public may potentially be exposed to more

aircraft disturbance where states, land owners, and managers desire removals. Many wildlife damage management programs in the west already use aircraft to control damaging wildlife, and some states in the east may add aircraft to their list of FSDM options. Like the Current FSDM Program (Alternative 1), aircraft would also be used for surveillance and to provide logistical support for ground based feral swine removal operations. APHIS-WS estimates approximately 1500 hours of flight time, primarily helicopter, would be added above current aircraft use nationally. Put in perspective, the contiguous United States is about 3.1 million square miles of land and water area. Even if only 25 percent of this area were subject to potential aircraft disturbance for FSDM, it would be a negligible addition at the average rate of about twelve minutes per square mile, per year. Furthermore, only some of the aerial work would be noticeable by the public. Like the Current FSDM Program (Alternative 1), any aircraft disturbance would be temporary and of short duration. Aircraft use would be planned in coordination with land management agencies that identify locations or times when flying should be avoided. Because federal, state, territorial, and tribal land managers are consulted in planning, aircraft use in high use recreational areas or other sensitive areas can be avoided.
Depending on the state, oftentimes aerial work would occur in remote locations.

Compared with the Current FSDM Program (Alternative 1), individuals are more likely to encounter warning signs associated with the placement of traps and snares, and this may disturb some members of the public. These signs are for the public's protection and their placement is temporary. Concerns are likely to be primarily for human and pet safety. This issue is discussed in Chapter 4, Section C.7. Like the Current FSDM Program (Alternative 1), corral and cage traps would be set in locations not visible from recreation facilities, roads, or trails, but because their use, like other FSDM methods, would increase, some individuals may hear or see the traps.

Where feral swine are present in high use recreation areas, land management agencies would be more likely to close some sections of parks or other recreation areas while FSDM removal operations take place. These closures would be temporary, and in some cases, it may provide an opportunity to educate the public about feral swine damage to the ecosystem.

As discussed under the Current FSDM Program (Alternative 1), APHIS-WS coordinates all proposed FSDM work with land management agencies to avoid conflicts with land use objectives including recreational uses. While efforts would increase, planning and coordination at the local level would continue to ensure that negative effects, such as closures and disturbance, are minimized.

### *c. Alternative 3: Baseline FSDM Program*

Effects on Feral Swine Hunting

This alternative provides the greatest amount of funding for baseline FSDM. Local impacts on feral swine hunting opportunities are likely to be greatest under this alternative in the short term. This alternative would not be as effective in stabilizing and reducing the national feral swine population, so hunting opportunities are likely to persist in many areas. Like the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively), the single greatest influence over feral swine hunting remains State, Territorial, and Tribal management objectives and regulations (Appendix D). Without National programs including research and national outreach efforts, assistance to States, Territories, and Tribes would rely only on baseline capacity to provide technical assistance and data for local agencies and legislators who are developing regulations on feral swine management, including opportunities for the public to hunt feral swine. Local APHIS-WS state programs would provide information and data to States, Territories, and Tribes to discourage hunters from moving feral swine. APHIS's ability to provide technical assistance for use in development of feral swine regulations would be lower than the Integrated FSDM Program (Alternative 2) but greater than the Current FSDM Program (Alternative 1).

<u>Effects on Hunting Other Game Species</u>

This Baseline FSDM Program would place all funding in operational FSDM. This would be likely to have the greatest initial local benefits to game species that are negatively affected by feral swine where states receive baseline funding and target affected areas. Without national population management efforts and strategic local projects, this alternative would be expected to be less effective over time as compared with the Integrated FSDM Program (Alternative 2). The negative effects of FSDM methods on individual game animals would be negligible as discussed in Section.C.2, above (Effects on Non-target Species).

<u>Effects on the Aesthetic Enjoyment of the Natural Environment</u>

The effects of the Baseline FSDM Program on aesthetic enjoyment of the natural environment would be similar to the Integrated FSDM Program (Alternative 2). Positive and negative impacts associated with local FSDM projects would increase in states with moderate to large feral swine populations because the amount of funding for FSDM would likely increase in these areas.
In areas with low or new populations that would have been identified as priorities for the national feral swine population control, funding for FSDM may decrease. In some areas, available funds may still be sufficient to eradicate swine, although it may take longer to achieve management objectives. In these areas, impacts would be identical to the Integrated FSDM Program (Alternative 2). In other areas, resources may not be sufficient to do more than address local damage problems. Viewing feral swine would still occur to some extent in those states where populations are well established, where feral swine are managed as a game

species, or where eradication is not feasible or desired. Similar to the Integrated FSDM Program (Alternative 2), people who enjoy the intrinsic value of feral swine would know that they still exist in the environment. Obviously, because feral swine would be eliminated in some states and population size and distribution would diminish, the interest of people who enjoy seeing feral swine or knowing they exist in nature would be adversely affected. The intrinsic value of feral swine needs to be weighed against the enormous damages they inflict on other aspects of the environment, including the aesthetic quality of the environment. Opportunities to enjoy benefits of feral swine would remain, but adverse impacts from feral swine would likely increase.

Disturbance to Recreationists

Similar to the Integrated FSDM Program (Alternative 2), activities would only be conducted where requests for assistance are made, and only per agreements with land managers and landowners. The loss of positive aesthetic values of feral swine would be traded for the removal of an invasive species and resultant benefit to the natural environment, including native wildlife and plant species that may be suppressed or displaced by the presence of feral swine.

This alternative would increase operational control actions over the Current and Integrated FSDM Programs (Alternative 1 and 2, respectively), which would increase the potential for disturbance to the public in more areas. Because aerial shooting is particularly effective and efficient under certain conditions when compared with other management methods, the recreating public may potentially be exposed to the most aircraft disturbance under this alternative where states, land owners, and managers desire removals. Many wildlife damage management programs in the west already use aircraft to control damaging wildlife and some eastern states may add aircraft to their list of FSDM options. This alternative could exceed the Integrated FSDM Program's (Alternative 2) estimated flight time, but because of low use, often occurring in remote areas, avoidance of sensitive and high use areas, and the temporary and short duration that potential exposure would inflict, public exposure to disturbance from aircraft use would still be expected to be minimal.

Compared with the Integrated FSDM Program (Alternative 2), individuals are somewhat more likely initially to be aware of FSDM activities. Some people may encounter warning signs associated with the placement of traps and snares and this may disturb some members of the public. These signs are for the public's protection and their placement is temporary. Concerns are likely to be primarily for human and pet safety, which is an issue that is discussed in Section 4.C.7. Like the Current FSDM Program (Alternative 1), corral and cage traps would be set in locations not visible from recreation facilities, roads, or trails, but because their use, like other FSDM methods, would increase, some individuals may hear or see the traps.

Similar to the Integrated FSDM Program (Alternative 2), where feral swine are present in high use recreation areas, land management agencies would be more likely to close some sections of parks or other recreation areas while FSDM removal operations take place. These closures would be temporary and, in some cases, it may provide an opportunity to educate the public about feral swine damage to the ecosystem.

Overall impacts would be similar to, but slightly greater in magnitude to, those described for the Integrated FSDM Program (Alternative 2). Coordination with cooperating agencies and precautions to reduce risk of disturbance to recreationists would be conducted in the same manner as for the Integrated FSDM Program (Alternative 2). Although operational management efforts would increase, planning and coordination at the local level would continue to ensure that negative effects such as closures and disturbance are minimized.

### *d. Alternative 4: National FSDM and Strategic Local Projects*

Effects on Feral Swine Hunting

This alternative would not provide baseline capacity funding for states with feral swine and, consequently, potential impacts would only occur in States with strategic local project and States identified as priorities for the national feral swine population and damage control effort. Impacts in areas where FSDM does occur may be more intensive because more resources may be allocated to these areas than under the Integrated FSDM Program, the Baseline FSDM Program and the Federal FSDM Grant Program (Alternatives 2, 3, and 5, respectively). As resources and funding move from areas cleared of swine damage to new areas over time, more states, territories and tribes would see some effects. National feral swine population stabilization and eradication objectives and associated loss in feral swine hunting opportunities may be achieved more rapidly than under other action alternatives. In the case of national priority states, efforts would initially be focused on small or new populations and would not affect established hunting in areas with the largest populations until earlier objectives are met or when and where strategic localized projects may be focused. Individuals who may have been anticipating new feral swine hunting opportunities from small or emergent populations may be adversely affected. Over time, the effects would be focused increasingly on states with large and established populations. Like the other alternatives, the single greatest influence over feral swine hunting remains state, territorial, and tribal management objectives and regulations (Appendix D). This alternative would emphasize national efforts to provide information to States, Territories, and Tribes to inform agencies and legislators developing regulations on feral swine management, including opportunities for the public to hunt feral swine. Baseline capacity would not be available to assist locally. The education and outreach under this alternative would include information and data to discourage hunters from moving feral swine.

Effects on Hunting Other Game Species

In states which are identified as priorities for national feral swine population management, eradication of feral swine and associated benefits would likely occur more rapidly than under the Integrated FSDM Program (Alternative 2). Because this alternative would apply more funding to national projects (e.g. research, national-level education, and outreach programs and materials) than any other alternative, it would likely provide beneficial effects based on long-term efficiency, efficacy, and ultimate success of FSDM. Most types of national projects would not directly affect game species but, similar to other species affected by feral swine, the potential for benefits would be a reasonable conclusion and could be correlated with the overall success of the program.

This alternative would have less capacity to address local adverse impacts on game species in states which are not priorities for national feral swine population management. No federal funding would be available for this type of project in low priority states unless the State or Territory receives funding for strategic local projects. Some State/Territory/Tribal lands with high feral swine populations and/or which do not intend to eradicate feral swine populations (Appendix D, Table 2) may not receive any funding for additional operational work. In those cases, benefits to game species that are negatively affected by feral swine would be similar to the Current FSDM Program (Alternative 1). Negative effects on individual game animals from FSDM methods would be negligible and would not affect populations.

Effects on the Aesthetic Enjoyment of the Natural Environment

Impacts of this alternative would vary depending on whether or not the State, Territory, or Tribe is an area identified as a priority for national feral swine population management or if it receives funding for strategic local projects. In States, Territories, and Tribal areas identified as priorities for national population management, impacts would be similar to the Integrated FSDM Program (Alternative 2). The loss of the positive aesthetic value of feral swine in those locations would be minimal compared with the benefit to the natural environment from removing this invasive species. The potential for the public to encounter warning signs for equipment or hear or see aircraft associated with FSDM would be similar to or less than other alternatives since baseline funding would not be available to control feral swine in states with large populations. Carcass disposal effects in terms of odor and air quality are discussed in Section 4.C.4

In State, Territories and Tribal areas that are not identified as national priorities, but which receive funding for strategic local projects, local impacts in the project areas would be intermediate to the Integrated FSDM Program (Alternative 2) and Current FSDM Program (Alternative 1), but overall impacts would be more similar to the Current FSDM Program (Alternative 1). Impacts in all other areas would be similar to the Current FSDM Program (Alternative 1).

Because this alternative would apply more funding to national projects (e.g. research, national-level education, and outreach programs and materials) than any other alternative, it would likely provide beneficial effects based on long-term efficiency, efficacy, and ultimate success of FSDM

Disturbance to recreationists

States, Territories, and Tribal lands identified as priorities for national projects would experience impacts similar to the Integrated FSDM Program (Alternative 2). Impacts in the remaining areas would be similar to the Current FSDM Program (Alternative 1) although there may be some increases in impacts in areas where strategic local projects are conducted. Impacts in strategic local project areas would be similar to the Integrated FSDM Program (Alternative 2). SOPs discussed under the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively) would limit potential exposure and disturbance to the recreating public.

***e. Alternative 5 - Federal FSDM Grant Program***

APHIS-WS would not directly affect feral swine hunting, other game animals, aesthetic enjoyment of the natural environment, or disturb recreationists under this alternative since it would not implement FSDM operations. The FSDM Grant Program would require that a substantial amount of funding be committed to oversight, compliance, and monitoring. Because the grant program would require implementation of SOPs and other measures to minimize negative effects, the impacts would be related to the degree that grant recipients followed protocol established for resource protections.

Effects on Feral Swine Hunting

Overall, because less operational funding would result in a less effective program, it is likely that fewer feral swine would be removed, and the negative effects on feral swine hunters and hunting businesses (Section 4.C.9) would be lower than the Integrated FSDM Program, the Baseline FSDM Program, and National FSDM and Strategic Local Projects (Alternatives 2, 3, and 4, respectively), but greater than the Current FSDM Program (Alternative 1). Like the other alternatives, the single greatest influence over feral swine hunting remains state, territorial, and tribal management objectives and regulations (Appendix D). This alternative would not emphasize National or baseline efforts to provide information to States, Territories, and Tribes to inform agencies and legislators developing regulations on feral swine management, including opportunities for the public to hunt feral swine. Grant recipients could potentially provide education and outreach to agencies and legislators about regulations that affect hunting and the consequences of moving feral swine to increase hunting opportunities, but it would not be likely to be widely or systematically applied.

Effects on hunting other game species

Benefits to hunters of other game species would probably be lower than under the Integrated FSDM Program, the Baseline FSDM Program, and National FSDM and Strategic Local Projects (Alternatives 2, 3 and 4, respectively) but greater than the Current FSDM Program (Alternative 1), commensurate with the efficacy of this alternative and effects on feral swine populations, which is discussed under Section 4.B.1.

Effects on the aesthetic enjoyment of the natural environment

Whether or not this alternative might provide more benefits than the Current FSDM Program (Alternative 1) would depend on the efficiency of grant recipients that deliver FSDM services. This alternative is not likely to provide as much potential benefit to the natural environment that is harmed by feral swine because fewer feral swine populations would likely be eliminated compared with the other alternatives.

Disturbance to recreationists

Disturbances to recreationists would depend on the individual practices of grant recipients and the ability of APHIS to control implementation of SOPs and other measures such as those may be required by land and resource management agencies. Assuming full compliance, recreationists would not be disturbed more than under the Current or Integrated FSDM Programs (Alternatives 1 and 2, respectively).

### 6. Climate Change Impacts

The *State of the Climate in 2012* (Blunden and Arndt 2013) report indicates that since 1976, every year has been warmer than the long-term average. Global surface temperatures in 2012 were among the top 10 warmest years on record with the largest average temperature differences in the United States, Canada, southern Europe, western Russia, and the Russian Far East (Osborne and Lindsey 2013). Impacts of this change would vary throughout the United States, but some areas would experience air and water temperature increases, alterations in precipitation, and increased severe weather events.

The distribution of a plant or animal species is often dictated by temperature and precipitation. According to the EPA (2013), as temperatures continue to increase, the habitat ranges of many species are moving into northern latitudes and higher altitudes. In the case of feral swine, this facilitates range expansion. While feral swine do not impact climate change directly, the cumulative impact of damage from feral swine in a growing number of ecosystems already stressed from climate change may cause irreversible ecological changes. Climate change, habitat degradation, and pollution are stressors that contribute to species extinction (Fischlin 2007). In Hawaiian native forests, researchers determined that feral swine influence soil respiration, which can subsequently impact terrestrial carbon cycling (USDA 2013). Additionally, the warming trend in the United States could further influence the reproductive success of feral swine by ensuring abundant food sources in an increasing number of areas. The higher the nutritional value of a hog's diet, the greater the reproductive success (Giuliano 2013).

APHIS recognizes that climate change is a concern of the public. FSDM has the potential to produce criteria pollutants (pollutants for which maximum allowable emission levels and concentrations are enforced by state agencies) while working in the office, during travel from office to field, travel in the field (vehicles or ATV), and from short-term aircraft activities.

#### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

The CEQ has advised Federal agencies to consider whether analysis of the direct and indirect greenhouse gas (GHG) emissions from their proposed actions may provide meaningful information to decision makers and the public. Based on their review of the available science, CEQ advised agencies that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of $CO_2$-equivalent GHG emissions on an annual basis, significant impacts on the environment from the action were possible and the agencies should consider that a quantitative and qualitative assessment may be meaningful to decision makers and the public. APHIS has assessed the potential GHG impacts from the current and proposed actions in context of this guidance.

The average person in a home produces 4 metric tons of carbon dioxide equivalents (CDEs; includes $CO_2$, $NO_x$, CO, and $SO_x$) annually (EPA 2010). APHIS has 170 district and state offices, and this includes district offices with only one staff person. Each state office would likely produce fewer CDEs annually than the average home because little electricity is used at night and on weekends. APHIS cannot predict the fuel efficiency of each ATV used in the field nor can it predict how often an ATV would be used. However, if a conservative estimate of 20 miles per gallon is used and consideration is given to total mileage being substantially less than the mileage calculated for normal vehicular use, the effects of ATVs on air quality would be negligible. APHIS also cannot predict the fuel efficiency of each vehicle used to conduct FSDM; however, APHIS will use the Federal Highway Administration's (FHWA) estimated average combined fuel economy of cars and light trucks of 21.5 miles per gallon (mpg) in the discussion of alternatives.

APHIS vehicles are used for a multitude of wildlife management projects, including Current FSDM Program activities. To establish baseline data for comparison to the other alternatives, APHIS calculated the CDEs from its current fleet of passenger vehicles (1,665 leased and owned vehicles) using the average vehicle miles traveled per year as calculated by FHWA (2012).[21] APHIS used the ratio of $CO_2$ emissions to total greenhouse gas emissions (CDEs) for passenger vehicles to complete the calculation.[22] Current APHIS vehicle use for all wildlife management programs can contribute approximately 8,058 metric tons (MT) of CDEs each year.[23]

Helicopters are the preferred aircraft for feral swine aerial management activities; however, fixed wing piston engine aircraft also will be operated for FSDM. APHIS either owns or leases 10 different types of helicopters; their average fuel consumption is 24.88 gallons per hour (gph). Helicopters with this average fuel consumption emit approximately 0.24 MT/hr of $CO_2$ emissions.[24] APHIS also owns or leases 6 different types of aircraft. Average fuel consumption rates for fixed wing piston engine aircraft is 12.9 gph (FAA 2012). Average $CO_2$ emissions for piston engine aircraft are 0.11 MT/hr (Conklin and de Decker 2014). Less than 1 percent each of $NO_x$, CO, $SO_x$, and other trace components are emitted from aircraft engine emissions (FAA 2005).

APHIS flew 10,426 hours (helicopter and fixed wing combined) in FY13. APHIS flew an additional 4,225 hours under contract. If all flight hours were attributed to fixed wing planes, the estimated $CO_2$ emissions would be 1,612 MT/year. If all flight hours were attributed to helicopters, the estimated $CO_2$ emissions would be 3,516 MT/year. Given that feral swine activities do not comprise all aerial program activities in a year, estimated yearly $CO_2$ emissions from the feral swine program would be less than the range of 1,612 – 3,516 MT for the entire aerial operations program.

Combining vehicle, aircraft, office, and ATV use for FY13 and potential new vehicle purchases, the range of CDEs is likely to be 10,350 – 12,254 MT or less per year, which is below the CEQ's suggested reference point of 25,000 MT/year[25].

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[21] 11,493 miles per vehicle per year.
[22] 0.985
[23] ($8.92 \times 10^{-3}$ metric tons/gallon of gasoline)*(19,135,845 miles traveled by WS)*(1/21.5 mpg)*(1/0.985)
[24] Conklin and de Decker Aviation Information (https://www.conklindd.com/CDALibrary/CO2Calc.aspx)
[25] CEQ (2010) issued a memorandum to heads of federal agencies and departments on providing draft guidance on when and how to analyze the environmental impacts of greenhouse gas emissions and climate change under NEPA. A suggested 25,000 metric tons of carbon dioxide equivalent emissions from the proposed action would trigger the need for a quantitative analysis.

### *b. Alternative 2: Integrated FSDM Program (Preferred Alternative)*

APHIS does not expect the number of offices to increase substantively under this alternative because the program would give emphasis to reallocation of existing personnel. New personnel would likely be located in existing facilities.

Current APHIS vehicle use for all wildlife damage management programs can contribute approximately 8,058 metric tons (MT) of CDEs each year.[26] If, however, APHIS purchased a new vehicle as a result of FSDM in each state and territory with feral swine, 43 new vehicles could be purchased. The estimated CDEs from the hypothetically expanded fleet of vehicles are approximately 8,266 MT. Mileage per vehicle is expected to stay the same or slightly increase, and there would likely be a negligible increase of ATV use under the Integrated FSDM Program.

The Integrated FSDM Program is estimated to increase the flight time by approximately 1,500 hours[27] which would increase the range of $CO_2$ emissions from aircraft to 1,777 – 3,876 MT/year. An additional two helicopters also would likely be purchased under this alternative. The cumulative range of CDEs for the program under the Integrated FSDM Program is likely to be 10,723 – 12,822 MT or less per year. This range also is less than the suggested reference point from CEQ of 25,000 MT/year.

### *c. Alternative 3: Baseline FSDM Program*

Under this alternative, all funding would be allocated to baseline operational FSDM. This is likely to result in a slight increase in the use of vehicles over that predicted for the Integrated FSDM Program (Alternative 2). Preliminary estimates indicate that funding to states for operational FSDM could increase 10-20% from levels predicted for the Integrated FSDM Program (Alternative 2). This level of increase in operational FSDM would not elevate the cumulative national CDE output beyond the CEQ suggested reference point of 25,000 MT/year.

### *d. Alternative 4: National FSDM and Strategic Local Projects*

Under Alternative 4, the cumulative CDEs would be similar to the emissions under the Integrated FSDM Program (Alternative 2). Aircraft usage would likely stay the same as the Current FSDM Program (Alternative 1) since the aerial program is used most often in high priority areas. Vehicle use may decrease if some APHIS-WS state programs do not receive funding until management

[26] ($8.92 \times 10^{-3}$ metric tons/gallon of gasoline)*(19,135,845 miles traveled by WS)*(1/21.5 mpg)*(1/0.985)
[27] We estimated that in addition to current aircraft use, three additional aircraft would be used under the Integrated FSDM Program. The three additional aircraft are expected to fly 500 hours per year each, which includes ferry time to project locations.

objectives are achieved in high priority areas. ATV and office usage would remain the same.

#### e. *Alternative 5: Federal FSDM Grant Program*

Under this alternative, more money would be allocated to administration and less to operational management. Administrative tasks are expected to have a lower carbon footprint than operational management. Additionally, cumulative CDEs under this alternative would likely be less than CDEs in the Integrated FSDM Program (Alternative 2) because the lack of national support would make it more challenging for States, Territories, and Tribes to acquire aircraft to conduct aerial operations.

### 7. Effects on Human Health and Safety

FSDM has the potential to affect human health and safety whether implemented by APHIS-WS, other agencies, or the public. Impacts resulting from implementing FDSM methods can range from direct injury to indirect impacts (e.g., impacts to water quality). As noted in the need for action (Chapter 1 Section, Chapter 3 Section ), FSDM is also conducted in some areas to reduce risks to human and pet health and safety from feral swine-vehicle collisions, transfer of zoonotic diseases and aggressive feral swine. APHIS-WS incorporates many measures as SOPs (Section 2.E.) to minimize or nullify risks to the public.

#### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

FSDM methods which may pose risks to human health and safety include firearms, use of aircraft for shooting and surveillance, snares, leg-hold traps, pyrotechnics for hazing, cage traps, drugs, the reproductive inhibitor GonaCon™ injectable (if registered for use in feral swine), and handling feral swine carcasses. When used by APHIS-WS, the proposed FSDM methods pose minimal threat to human health and safety. No adverse effects on human health and safety have occurred or have been reported to occur from APHIS-WS' use of FSDM methods from FY09 through FY13. FSDM operations are implemented only by request, and only as specified in MOUs, cooperative service agreements, or similar documents developed in coordination with land owners and managers. APHIS-WS employees who conduct FSDM activities are knowledgeable in the safe and effective use of the methods described in Chapter 2, Section F, the SOPs described in Section 2.G, and relevant APHIS-WS Directives. Safety considerations are always considered in the decision making process as outlined in the APHIS-WS Decision Model (Slate et al. 1992; Figure 2-1, Chapter 2, Section C). Safety risks depend not only on the method used, but also on the location and timing of use. Property ownership or jurisdiction and land use are considered in assessing safety risks. For example, private property in a rural area with limited or controlled access would raise fewer safety concerns with FSDM methods than would a public park. In both cases, close coordination with either the land owner or land managers helps to ensure that human safety risks are minimized. Some measures to reduce risks on public lands include avoiding high use areas, working in closed areas, or timing operations to occur when the public is not present (off-season, at night, or early morning). Another routine precaution taken regardless of land ownership is posting warning signs at access points. The risks and additional precautions specific to the methods are discussed below.

An MOU, CSA, or similar document would list the methods the cooperator agreed could potentially be used on property owned or managed by the cooperator. At the time the agreement is prepared, and as needed thereafter, APHIS-WS would consult with the landowner regarding any risks which may be associated with the proposed methods and strategies to reduce or prevent risks.

<u>Non-chemical Methods</u>

***Shooting:*** Shooting with shotguns or rifles is used to reduce feral swine damage when lethal methods are determined to be appropriate. Shooting is selective for target species. To help ensure safe use and awareness, APHIS-WS employees who use firearms during official duties are required to attend an approved firearm safety-training course and to remain certified for firearm use in accordance with the APHIS-WS Directive 2.615. As a condition of employment, APHIS-WS employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law (18 USC § 922(g)(9)), which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms are deemed appropriate to alleviate or reduce feral swine damage and threats to human safety at a site. APHIS-WS would work closely with cooperators to ensure all safety issues were considered before firearms would be included in agreements and used.

The use of lead ammunition during shooting activities has the potential to impact human health and safety. The toxicity of lead to humans has been well documented due to its widespread historical and current use. Lead affects the neurological system, cardiovascular system, renal system, immune system, hematological system, and developmental system in humans and other mammals. The body integrates lead into its composition by substituting lead for other essential elements or nutrients, such as calcium which is used in many different processes in the body. Children are especially vulnerable since they are able to absorb lead more efficiently and are in contact more with media that may be contaminated with lead. Prolonged lead exposure in children may cause damage to the brain and nervous system, behavioral problems, anemia, liver and kidney damage, hearing loss, hyperactivity and developmental delays. Lead is also a probable human carcinogen and is considered mutagenic.

Lead exposure and risk to human health from FSDM activities is not expected to result in significant risk to any subgroups of human populations (such as APHIS-WS personnel, and the general public, including minority populations, children, and hunters). There is potential for exposure and risk to APHIS-WS personnel who handle lead ammunition. However, exposure and risk is expected to be low because firearms are used outdoors reducing inhalation exposure from lead fumes and dust that may occur during firing. In addition, APHIS policies and practices for APHIS-WS personnel handling firearms would reduce the potential effects of lead exposure as well as reduce the potential for injuries related to discharging a firearm.

Subgroups of the public that could be exposed to lead ammunition from FSDM activities are people who consume feral swine that have been wounded or shot by APHIS-WS personnel. Lead exposure can cause serious health problems, particularly for pregnant women and children. Because of the Meat Inspection Act requirements for pre and post mortem inspections of swine prior to entering the public food supply (e.g., food banks), feral swine collected by APHIS-WS personnel from lead shooting would not be donated to food banks. Swine taken by APHIS-WS could be donated to and consumed by the landowner/manager. Risks to these individuals are expected to be similar to risks hunters experience when consuming game meat that they harvest. In a 2008 study by the CDC and North Dakota Departments of Health, Agriculture, and Game and Fish, blood lead levels were checked in 738 volunteers who made varying use of wild game harvested with lead bullets (Iqbal 2008). Study results indicated that there was a slight elevation in blood lead levels in individuals who ate a lot of wild game, but no participant had blood lead levels higher than the CDC recommended threshold of 10 g/dl – the level at which CDC recommends case management. Additionally, the mean blood level for the study population was lower than for the overall U.S. population.

Feral swine that are killed by APHIS-WS personnel and left on-site could potentially be obtained and consumed by individuals other than the landowner/manager. This is not expected to be a significant exposure pathway because carcasses left in the field would typically be away from roads or other public areas and would not be fit for human consumption due to rapid scavenging and decomposition of the carcass. Feral swine that are wounded during shooting by APHIS-WS personnel could occasionally be harvested later by hunters. In this scenario, there is the potential for lead exposure from bullets or fragments to be present in tissue that could be used for human consumption. However, this type of exposure is expected to be minor for several reasons. First, the goal of APHIS-WS personnel when using ammunition is efficient and effective lethal control, ensuring a quick, humane death. Secondly, areas where fragments of lead may occur would be noticed by hunters and those fragments removed during preparation of the meat for consumption. Finally, the potential for lead exposure would be reduced in cases where APHIS-WS personnel can use non-lead ammunition. Over time, the use of lead ammunition is expected to decrease as non-toxic shot becomes more readily available (as discussed under Section 4.C.2). Therefore, the low potential for lead exposure from activities related to FSDM is expected to result in negligible risk.

***Use of Aircraft:*** In many areas in the west, aerial operations primarily occur in relatively remote areas with no or very low human presence on the ground; however, eastern states with more dense human populations may increase their use of aircraft. Low-level flights introduce hazards such as power lines and trees, and the safety margin for error during maneuvers is diminished compared to high-level flights. Accidents have been associated with APHIS-WS aerial operations and are a concern to APHIS-WS because of risks to personnel. Some of APHIS-WS' accidents have involved pilot error while others have been directly related to mechanical failure. APHIS-WS developed the APHIS-WS Aviation Training Center with the goal of reducing pilot error accidents to zero. The APHIS-WS Aviation Training Center provides safety training, individual instruction and aviation consultation to all aviation programs in APHIS-WS. The Center trains pilots to effectively respond to different types of mechanical failures and other safety concerns associated with low-level flight. APHIS-WS complies with all FAA issued Service Bulletins, Airworthiness Directives, aircraft manufacturing recalls, and similar documents.

In 2007 and 2008, APHIS-WS conducted a programmatic safety review to assess and improve employee safety (USDA 2008). The review covered nine APHIS-WS program areas including the aviation program. The review of the aviation program was conducted by the Interagency Committee on Aviation Safety. The review team concluded that the APHIS-WS aviation program is being operated in a safe, efficient, and effective manner and that the program met the Interagency Committee on Aviation Safety requirements for the Gold Standard Certificate for Excellence. At the time of the review, the APHIS-WS program was the only USDA aviation program to be awarded this certification. APHIS-WS program pilots and contractors are highly skilled with commercial pilot ratings and have passed proficiency tests in the flight environment encountered by APHIS-WS. APHIS-WS pilots are trained in hazard recognition and surveillance flights would only be conducted in safe environments. Federal aviation regulations require pilots to fly a minimum distance of 500 feet from structures and people, and all employees involved in these operations are mindful of this. Lower altitudes are allowable for helicopters (14 CFR 91.119). Although the goal of the aviation program is to have no accidents, accidents may still occur. However, the protective measures implemented by APHIS-WS keep the risk of aircraft accidents and injuries to the public and aircraft crew low. Other analyses of aircraft accidents by APHIS-WS concluded that the accident rate for APHIS-WS pilots and aircraft is not significantly different from the rates reported for general aviation and that the risk of harming any member of the public is exceedingly low (USDA 2011a, USDA 2011b).

APHIS-WS' safety measures and training for aerial sharpshooting are the same as those for aircraft used in surveillance with the addition that the individuals conducting the shooting also have specialized training in the safe and effective use of sharpshooting from aircraft. APHIS-WS' employees must have a clear view of the animal before shooting, so there is no risk of accidentally shooting a person. Aerial operations used in FSDM are not expected to present any significant risk to human health or safety.

Aerial wildlife operations, like any other flying, may result in an accident. APHIS-WS pilots and crewmembers would be trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The national APHIS-WS Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of an APHIS-WS Flight Training Center and annual recurring training for all pilots. Still accidents may occur and the environmental consequences should be evaluated. Although fires could result from aircraft-related accidents, no such fires have occurred from aircraft incidents previously involving government aircraft and low level flight.

***Tracking/Trailing Dogs:*** In some situations, APHIS-WS employs the use of tracking/trailing dogs to locate or pursue feral swine. APHIS-WS State Directors will maintain a list of approved personnel permitted to use trained dogs to track or trail feral swine during damage management activities. APHIS-WS approved personnel are aware of and will abide by APHIS-WS Directive 2.445, which requires that APHIS-WS personnel handle and maintain trained dogs such that the dogs do not pose a threat to people or domestic animals. Dogs would only be used in areas where APHIS-WS has landowner or land manager permission to use the technique. The use of well-trained dogs by experienced handlers is not expected to result in adverse impacts on human health or safety.

***Carcass Disposal:*** The risks to human health and safety stemming from feral swine carcass disposal would be negligible based on the limited number of carcasses and their distribution (Section 4.B.1) along with the various methods of disposal available (Section 2.F.11). Feral swine carcasses that are left on-site would pose only a very limited disease risk to human health and safety. The putrefication process would destroy most disease causing agents and, although this process is slower in colder climates, most carcasses of any size will undergo necrosis quickly (T. Gidlewski, NWRC, pers. comm. 2014). Further, the process of putrefication and decay produce an environment that is toxic to most pathogens. Most disease agents require a live host for maintenance and propagation and fail to survive when their host dies. Although prion diseases are known to be particularly persistent in the environment, they are not known to occur in feral swine (T. Gidlewski, NWRC, pers. comm. 2014). Feral swine carcasses infected with anthrax may leave disease causing spores in the environment, but because feral swine are relatively resistant to anthrax, infection of feral swine is likely associated with the consumption of infected ruminant carcasses that have already contaminated the environment (T. Gidlewski, NWRC, pers. comm. 2014). As per APHIS-WS Directive 2.515, all carcass disposals will be made in a manner that demonstrates APHIS-WS' recognition of public sensitivity to the viewing of wildlife carcasses. As such, feral swine carcasses left in the field would generally not be left in locations frequented by the general public and would only be left with landowner permission. The potential for the general public to encounter a feral swine carcass would be expected to be extremely remote.

In general, very little information is available regarding the length of time disease agents persist in the burial environment or the potential for dissemination from the burial site. Concerns stem from the fact that burial, unlike some other disposal methods such as incineration or rendering, serves only as a means of eliminating carcass material, but does not necessarily eliminate disease agents that may be present (NABCC 2004). The question arises as to the possibility that disease agents could disseminate from the burial site and pose a risk to human health (NABCC 2004). Although APHIS-WS has identified that carcasses of feral swine removed during FSDM activities may be left on-site, buried on site, or buried in approved landfills, the number of carcasses disposed of in any given area would be minimal. The potential for carcasses to harbor diseases may be unknown unless the feral swine were specifically targeted for disease monitoring and surveillance. In any case, feral swine that are host to a disease agent would have died in place and/or may have spread the disease to other swine or other animals if not removed in FSDM. Thus, overall risks from on-site burial or composting may not exceed the status quo as long as carcass numbers are not concentrated.

Carcasses may be kept by the landowner/manager for their use and use by family and employees. However, there are risks to human health from consuming feral swine that may not necessarily occur with domestic swine. Feral swine are known to carry diseases, such as swine brucellosis, which have been eradicated from the commercial swine herds in the U.S. or which are uncommon in meat from domestic swine due to biosecurity and handling and production practices (Louisiana Office of Public Health 2013, Pederson et al. 2014, CDC 2009, 2014). People can contract these diseases and others through contact with animal body fluids and tissues while processing carcasses and/or through improperly cooked meat. When landowners request to keep feral swine for their use, APHIS-WS will inform them of the health risks associated with handling and consumption of feral swine and proper precautions to minimize risks (e.g., Davis and Ivey 2011, CDC Undated).

***Traps and Snares:*** The use of live-capture traps, foothold traps, and snares has been identified as a potential issue. Live-capture traps available for feral swine would typically be walk-in style traps where feral swine enter, but are unable to exit. Live-traps, foothold traps, and snares would typically be set in areas where human activity was minimal to ensure public safety. Those methods rarely cause serious injury and would only be triggered through direct activation of the device. Human safety concerns associated with live-traps, foothold traps, and snares would require direct contact to cause bodily harm. Signs warning of the use of those tools in the area would be prominently posted to increase awareness that those devices were being used and to avoid the area. Therefore, if left undisturbed, risks to human safety would be minimal. However, there have been incidents of individuals injured while freeing companion animals from foothold traps. Given the placement of warning signs, coordination with landowners/ managers, adherence to APHIS-WS directives on the use of traps, and the fact that foothold traps are not a preferred method for FSDM (Section, B.1.a above) risks of this type of injury are very low.

<u>Chemical Methods</u>

The human health concerns relative to using chemical methods in FSDM generally involve the potential for human exposure either through direct contact with the chemical or exposure to the chemical from feral swine that have been exposed (i.e., eating feral swine that have consumed or been treated with a FSDM chemical). Chemical methods currently available include immobilizing drugs and euthanasia chemicals. The injectable formulation of the reproductive inhibitor GonaCon™ could be used if registered with EPA.

***Immobilization and Euthanizing Drugs:*** Under this alternative, immobilizing drugs and euthanasia chemicals would be used infrequently. Immobilizing drugs would be limited to situations where swine would be sedated to fit radio collars and/or to collect samples and then be released. When euthanasia chemicals are administered, immobilizing drugs would also be administered prior to the use of euthanizing chemicals. Immobilization of feral swine minimizes stress to the animal and reduces the likelihood of injury to the individual captured and for the safety of personnel handling the swine. Immobilizing drugs would be administered according to recommended methods and doses from published sources. Immobilizing drugs used by APHIS-WS are fully reversible with a full recovery of the sedated animals. A list and description of immobilizing drugs available for use under the identified alternatives is available in Chapter 2, Section E.8.a. If feral swine were immobilized for sampling or to be fitted with a radio collar and released, risks could occur to human safety if harvest and consumption occurred prior to the end of the withdrawal period for the drug. APHIS-WS marks animals which have received immobilization drugs with a tag that provides a phone number to contact before consumption. APHIS-WS personnel that may use drugs for immobilization and euthanasia are certified through APHIS-WS and abide by APHIS-WS policies and SOPs and applicable Federal, State, Territorial, Tribal, and local laws and regulations.

In general, due to the cost of the drugs, the need to handle each animal and concerns regarding disposal, euthanizing chemicals would rarely be used as part of FSDM. Euthanizing chemicals would be administered after live capture and immobilization and under close monitoring. Euthanized feral swine are disposed of in accordance with APHIS-WS' Directives (2.430 and 2.515) and therefore, would not be available for harvest and consumption.

***GonaCon™:*** Reproductive inhibitors are currently under investigation as a potential nonlethal option to help reduce feral swine populations and associated damage. However, at this time, no methods are currently approved by EPA or FDA for feral swine control (Chapter 2 Section E.8.b). Of the methods currently under investigation, the injectable formulation of GonaCon™ is the most likely to be available for FSDM in the near future. Data on this type of use are sufficient for analysis of risks associated with this method and are presented in this DEIS. Consequently, in the event that an injectable formulation of GonaCon™ is registered for use in feral swine, it could be available for use without additional supplementation of this EIS. Because of the many issues that have not yet been resolved regarding the impacts of feed-based reproductive inhibitors, these methods would be subject to additional NEPA analysis prior to inclusion in any APHIS FSDM operational program.

Available toxicity data for GnRH suggests the active ingredient is essentially non-toxic to mammals. This is reflected in the lowest toxicity (Category IV) for acute oral, dermal, inhalation, and ocular exposure routes determined by EPA/Office of Pesticide Programs (OPP) (USEPA 2009). The potential exposure to humans is the greatest for workers; however, exposure and subsequent risk is expected to be minimal based on label requirements and restrictions. Labeled requirements regarding personal protective equipment (PPE) and prohibition of allowing pregnant women from handling the product may reduce the exposure and risk to this portion of the population. Additionally, GonaCon™ is classified as a Restricted Use Pesticide and all users must be certified pesticide applicators, or be under the supervision of a certified pesticide applicator. For both EPA/OPP approved GonaCon™ labels for use in deer its use is further restricted to APHIS-WS or state wildlife management agency personnel or persons working under their authority. The product label for equines (wild horses and burros), is restricted to employees of APHIS-WS and VS, BLM, FWS, NPS, U.S. Department of Defense, Federally recognized Indian Tribes, State agencies responsible for wild or feral horse and burro management, public and private wild horse sanctuaries, or persons working under their authority. In addition, both labels specify that applicators are not to use these products near humans, domestic animals, and pets and the products are required to be registered with states prior to use. A labelled use for feral swine would be anticipated to have similar restrictions to those proposed for the current labels resulting in minimal risk to workers and the general public.

The other subgroup of the population that could be exposed to GonaCon™ are people who harvest and consume feral swine that are treated with GonaCon™. The potential for exposure and risk to this part of the population is also expected to be minimal. In addition, exposure to GnRH would only be anticipated for meat that is consumed at the injection site immediately after dosing. The half-life of GnRH is short (< 1 hour) and would degrade prior to the animal being harvested. However, if a person does consume a treated game animal shortly after administration, that person is unlikely to be adversely affected because the active ingredient GnRH is a protein, which is digested into its component amino acids instead of absorbed intact in the digestive tract of mammals.

SOPs employed by APHIS-WS to reduce risks are discussed in Chapter 2, Section H. Meeting the requirements of the Animal Medicinal Drug Use Clarification Act of 1994 (21 CFR 530) should prevent any adverse effects on human health with regard to this issue. All APHIS-WS personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives (see APHIS-WS Directive 2.430) would ensure the safety of employees applying chemical methods. Feral swine euthanized by APHIS-WS or taken using chemical methods would be disposed of in accordance with APHIS-WS Directive 2.515. All euthanasia would occur in the absence of the public, whenever possible, which would minimize risks.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, issued on April 21, 1997, requires each Federal agency to identify and assess environmental health and safety risks that may disproportionately affect children as a result of agency actions. The proposed feral swine management activities would use only legally available and approved damage management methods; therefore, it is highly unlikely that children would be adversely affected. Feral swine management activities, in contrast, may reduce adverse environmental health or safety risks to children caused by feral swine.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, issued on February 11, 1994, requires each Federal agency to identify and address any disproportionate high and adverse human health or environmental effects of programs, policies, and decisions on minority, low-income, and tribal communities in the United States and its territories and possessions. Feral swine attacks and vehicle collisions, although infrequent, have occurred (Beasley et al. 2013, Mayer 2013, TAMU 2013); therefore, a reduction in feral swine populations in areas with low-income, minority, and tribal communities would increase the safety of the people in these communities as it would in any other community where similar FSDM activities are conducted. The health of these communities also may be improved if they rely on water sources in areas with large feral swine populations. Feral swine increase sedimentation in water by damaging vegetation and increasing soil erosion. Increased levels of pathogenic bacteria and fecal coliform have been discovered in water bodies as a result of feral swine defecation in or near them (Kaller et al. 2007).

Feral swine represent a potential source of meat but donations of feral swine as a food source is not practical, feasible, or allowed in most cases. FSIS has ruled that all swine are subject to the Federal Meat Inspection Act and even if donated are considered to be in commerce; therefore, all animals must be processed under inspection at an official establishment. Additionally, many states may require additional clearances such as health certificates. Thus, based on these limitations, feral swine would not be likely to be donated to charities. Carcasses may be left with individual property owners where the swine were killed for personal consumption, if requested and allowed by law. In this case, information is provided to the landowner on health risks and on precautions to take to minimize risks while handling the carcass and cooking the meat. Hunting feral swine can also be a source of low cost supplemental food for some families (Chapter 3 Section F.1.d). Feral swine populations are continuing to increase in many areas under the Current FSDM Program. Consequently, impacts on use of feral swine as supplemental food under this alternative are likely limited and localized.

<u>Impacts of Feral Swine</u>

APHIS-WS works with cooperators on a case-by-case basis to assess the nature and magnitude of feral swine conflicts including providing information on the limitations about what we know regarding health risks associated with feral swine. In most cases, the risk of contracting a disease from feral swine is relatively low. Although reports of human illness associated with feral swine are rare, this may be due to the lack of reported human cases (Amass 1998). There are likely illnesses contracted from swine that people may perceive as the common flu that are left untreated, unreported, or misdiagnosed (Hutton et al. 2006). Cooperators may consider even a low level of risk to be unacceptable and others may wish to eliminate or minimize risks before human illness occurs because of conditions on their site.

While current biosecurity and herd health procedures minimize the occurrence of disease in domestic swine herds, diseases such as rabies, brucellosis, plague, tuberculosis, anthrax, and tularemia may occur sporadically in swine or other domestic livestock species, and can be costly to treat. The potential for injury, illness, or loss of human life as a result of human interactions with feral swine have been described in Chapter 3, Section H.1.b FSDM, if successful, could reduce the potential for zoonotic disease transmission between feral swine and humans, reduce the number of swine-vehicle related accidents and injuries from aggressive feral swine.

In conclusion, no adverse effects on human health and safety have occurred or have been reported to occur from APHIS-WS activities conducted from FY09 through FY 13. The overall risks to human safety from the Current FSDM Program are low. FSDM benefits human health and safety by reducing the potential for zoonotic disease transmission between feral swine and humans and by reducing the potential for swine-vehicle related accidents and conflicts with aggressive swine (Section 3.G).

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

The potential negative effects on human health and safety associated with the Integrated FSDM Program would be similar to the Current FSDM Program (Alternative 1). Even though operational activities using available methods would increase, program SOPs would continue to minimize risks (Section 2.G). Through a nationally coordinated effort, it is likely that feral swine populations would be eliminated or significantly reduced in many areas over time (Chapter 4 Section B.1).

This alternative would include a nationally coordinated feral swine disease monitoring program which will provide information on zoonotic diseases that health agencies can use to better understand and address potential risks to human health. Eliminating or reducing feral swine in areas would likely further reduce the risk of zoonotic disease transmission from feral swine, including brucellosis, trichinosis, tuberculosis, toxoplasmosis, *E. coli*, and leptospirosis. It would also further reduce the risk of vehicle-swine collision and injuries from aggressive swine as compared with the Current FSDM Program (Alternative 1). The national educational outreach and education component of this alternative may include materials to inform the public of measures they can implement to reduce risks to human health and safety (e.g., safe handling of feral swine intended for food use, practices which may reduce risk of incidents with aggressive swine).

With regard to the potential impacts on human health and safety from the use of lead ammunition during FSDM activities, APHIS-WS made informal recommendations to shift the use of lead ammunition in future FSDM programs toward the use of non-toxic shot such as Hevi-Shot®. Hevi-Shot® is a tungsten, nickel, and iron alloy, and is already in limited use by APHIS-WS field operations. Currently, no safety concerns with the use of Heavy-Shot® have been identified. Additionally, Hevi-Shot® does not pose a risk of ricochet during aerial operations even in rocky terrain. Under this alternative, the APHIS national FSDM program managers would try to work with manufacturers to place orders for the shot needed for all FSDM activities in order to maximize potential for economy of scale in ordering. The National FSDM Program is focusing on the transition to nontoxic shot first because the majority of feral swine taken will be taken from aircraft with shotguns and aerial shooting also likely constitutes the greatest use of a single type of ammunition. Should other types of non-lead ammunition be considered for use by APHIS-WS in the future, APHIS-WS would first ensure that the product meets APHIS-WS safety and humane standards. At this point in time, Hevi-Shot® is the only brand of non-lead ammunition that meets both these requirements and provides an acceptable alternative to traditional lead ammunition.

APHIS has considered whether project impacts occurring in minority and low-income populations and to minority farmers and ranchers appreciably exceeds or is likely to appreciably exceed those on the general public, and whether there would be an impact on the natural or physical environment that significantly and adversely affects an environmental justice population. APHIS-WS expects that there would be no additional negative impacts under the Integrated FSDM Program with regard to Executive Orders 13045 and 12898. Conversely, it would be expected that a national FSDM program would have greater benefits to human health and safety as discussed under the current FSDM program alternative because of improved efficacy in meeting program objectives. FSDM would have low risks to the public for the reasons explained above, and would only occur where requested and authorized by landowners/managers and in accordance with State/Territorial and Tribal management objectives for the species. These provisions help to ensure that individuals and communities will have a say in if and how FSDM is conducted in their area.

Feral swine attacks, although infrequent, have occurred (TAMU 2013), therefore, a reduction in feral swine populations in areas with low-income, minority, and tribal communities would increase the safety of the people in these communities. The health of these communities also may be improved if they use water sources in areas with large feral swine populations. Feral swine increase sedimentation in water by damaging vegetation and increasing soil erosion. Increased levels of pathogenic bacteria and fecal coliform have been discovered in water bodies as a result of feral swine defecation in or near them (Kaller et al., 2007). However, these benefits would likely also be realized by people in any community where FSDM is needed and implemented. Noise associated with feral swine management activities is not expected to have differing impacts between minority and low-income populations and the general public.

Additionally, APHIS-WS would expect a nationally coordinated FSDM program, such as under this alternative, to further reduce risks to the general public from disease threats associated with the presence of feral swine and would better protect public water sources by reducing or eliminating feral swine populations from critical watershed areas.

***c. Alternative 3: Baseline FSDM Program***

Under this alternative, all resources would be allocated to APHIS-WS state programs for baseline FSDM based on the size of the feral swine population in the States, Territories, and Tribal lands served by the APHIS-WS. Impacts on public health and safety from FSDM methods would be similar in nature to the Integrated FSDM Program (Alternative 2), but may be slightly greater in scope in some areas because additional funds will be available for operational FSDM. This alternative would likely be very effective in addressing local threats to human health and safety. However, in the absence of a nationally coordinated strategic allocation of resources to reduce the range and size of the feral swine population, feral swine populations in some states and territories and associated damage, will persist longer than under the Integrated FSDM Program (Alternative 2). Where populations are not eliminated, additional operations could be needed when feral swine return to project areas or expand into new areas. Longer term or more frequent operations would potentially increase risks over the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively), but public health and safety risks would still be expected to be low since SOPs are effective at minimizing public exposure and risk.

The ability for coordinated disease surveillance as described in the Integrated FSDM Program (Alternative 2) would not be increased without the National projects, thus the benefits to public health would be lower in this regard.

### *d. Alternative 4: National FSDM and Strategic Local Projects*

This alternative is also similar to the Integrated FSDM Program (Alternative 2), but involves no baseline funding. All funding under this alternative would be committed to national and strategic local projects. This alternative would focus all available resources on achieving national goals of containing and eradicating feral swine, FSDM research, conducting feral swine disease monitoring and working with international partners to address feral swine damage. APHIS-WS state programs supporting States, Territories, and Tribes with feral swine would only receive funding for FSDM when their state was identified as a priority for the national management program.

Under this alternative, funding for FSDM projects would be focused on APHIS-WS programs in states with feral swine which have been identified as a priority for the national program. Some states, were feral swine eradication is not feasible, may not receive any funding until program priorities and goals shift. Conversely, impacts to human health and safety that result from FSDM methods may be greater in high priority states receiving funding for FSDM. However, these impacts would be expected to be similar or less than those associated with the Integrated FSDM Program (Alternative 2).

### *e. Alternative 5: Federal FSDM Grant Program*

This alternative would distribute FSDM funding to States, Territories, Tribes, and others through a grant program based on National FSDM management objectives and local needs as described for the Integrated FSDM Program (Alternative 2). Feral swine control actions would be implemented by grant recipient agencies or their agents.

The administrative burden for this alternative would result in less funding available for FSDM. Although the amount of work conducted is likely to be less than the alternatives discussed above, any work conducted is likely to be similar to the current APHIS-WS activities and impacts to human health and safety from FSDM methods would be similar or less than those analyzed under the Current FSDM Program (Alternative 1).

Additionally, it is possible that less experienced personnel implementing FDSM methods could lead to greater risk to human health and safety than the other alternatives. As discussed above, under Alternatives 1 through 4, APHIS-WS personnel are required to adhere to specific requirements for training and certification in the use of several FSDM methods. Hazards to human health and safety could be greater under this alternative if the personnel implementing do not have the same level of training in FSDM methods as APHIS-WS personnel.

### 8. Socio Cultural Effects

This section evaluates and compares the effects of the alternatives on socio-cultural resources and values. It is subdivided into three sections: 1) cultural resources, with emphasis on compliance with the National Historic Preservation Act (NHPA), 2) impacts on tribes and traditional and cultural values (related to NHPA compliance but treated as a unique issue), and 3) humaneness and ethical perspectives. These potentially affected resources and values were identified and discussed in detail in Chapter 3, section D of this EIS.

#### *a. Alternative 1: Current FSDM Program (No Action Alternative)*

<u>Cultural Resources</u>

Consultations with States, Territories, Tribes, and other Federal agencies are an important part of ensuring that APHIS-WS considers cultural resources in project planning, and is a requirement of the NHPA (NHPA, Public Law 89-665, 16 U.S.C. 470 et seq.). The term “cultural resources” covers a wide range of resources including historic properties,[28] sacred sites, and archaeological sites not

[28] “Historic properties,” as defined by the NHPA, means any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the National Park Service. This term includes artifacts, records, and material remains that are related to and located within such properties. Properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined eligible for inclusion in the National Register (36 C.F.R. § 800.16(l)(1)).

eligible for the National Register of Historic Places. APHIS-WS complies with Section 106 of the NHPA by 1) determining if proposed projects have the potential to affect cultural resources; 2) consulting with the State Historic Preservation Office (SHPO) regarding the value and management of specific cultural, archaeological and historic resources; and 3) consulting with appropriate American Indian tribes or Native Hawaiian organizations to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. APHIS-WS combines NHPA planning with NEPA to include Federal, State, Territorial, Tribal, and public input. NHPA and state cultural resource laws may be triggered on any land classification.

Most APHIS-WS operational FSDM methods described in Section 2.C. do not cause major ground disturbance (Section 4.C.2), physical destruction or damage to property, alterations of property or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. In addition, the methods that are used by APHIS-WS under the Current FSDM Program are applied on a short term and temporary basis. Other than excavation for on-site burial and building permanent fences, the Current FSDM Program does not involve activities that have the potential to adversely affect historic properties.

Excavation for carcass burial has the potential to disturb historically important objects or sites which can be known or not yet discovered. Permanent fence post installation has the same potential and in addition, introduces a visual effect on the landscape. These actions may be in previously disturbed and fenced areas such as agricultural or other intensively managed lands but nonetheless, would require continuation of Section 106 compliance procedures (36 C.F.R. § 800.3(a)(1)). In this case, the SHPO and in the case of tribal lands, the Tribal Historic Preservation Office (THPO) or tribal representative would be contacted. On federal and state lands, including public and non-public lands, coordination with the land management agency through NEPA planning, work planning, and agreements is also used to help identify and avoid cultural resource conflicts. Identified conflicts would be likely to be resolved by relocating work sites to avoid impacts.

Protecting historic sites or other cultural resources or properties from feral swine damage can involve activities that may potentially indirectly or directly adversely affect the resource; however, in most cases, adverse effects would be unlikely due to the limited and temporary nature of the work. Benefits to the resource would likely occur from removing swine to prevent or stop damages. In cases where APHIS-WS may be requested to assist with the protection of cultural resources, land managers, agency archaeologists, SHPO, THPO/Tribal representative, and other agency experts, as appropriate, would be included in coordination to identify and resolve possible conflicts and to fully complete all steps necessary to comply with the NHPA. On public lands and on other federal lands, the land management agency requesting feral swine control could be designated as the lead agency for compliance with Section 106, and APHIS would cooperate in that effort.

Consultations with tribes and partner agencies on NEPA planning, and public outreach and monitoring is built into the Current FSDM Program. When and if cultural resource concerns are identified, APHIS-WS would develop measures to avoid or reduce harm to cultural resources and values. Where necessary, an agreement with the SHPO/THPO or affected tribes would ensue. It is unlikely that the Advisory Council on Historic Preservation would be consulted in most cases since FSDM actions are typically flexible enough that effects are likely to be able to be completely avoided by either using methods that do not adversely affect cultural resources, or avoiding sites or sensitive areas altogether. If there is a potential adverse effect, the SHPO, THPO/tribe, and other interested parties would have a chance to comment as required by Section 106. In addition, each partner agency also may have its own rules and regulations for compliance with NHPA. Appendix G contains a list of all potential FSDM methods with the potential effects on cultural resources and whether or not consultations with SHOPs, THPOs, and other agency personnel would be necessary.

<u>Impacts on Tribes, Traditional Cultures, and Ceremonial Values</u>

As noted in Chapter 3, Tribal response to and use of feral swine varies among tribes and among individuals within tribes. Factors influencing tribal perceptions of swine include the Tribe’s history of interaction with the species, impact of feral swine on the tribal economy and the finances of individual members, and impact of swine on culturally important resources. Tribes experience many of the same positive and negative impacts of feral swine on agriculture, health and safety, and hunting opportunities as other members of the American public. As with other members of the public, Tribes may also have concerns pertaining to the perceived waste of feral swine taken during damage management if the animals are not used by the landowner. The primary difference for the tribes relates to the interface between feral swine and cultural values and resources. For example, the damage by a non-native species is likely to be particularly unwelcome in tribal sacred sites. Tribes and tribal members with a deeply held sense of moral responsibility for the health of native species and ecosystems may consider reducing adverse impacts of feral swine a moral imperative. However, tribes in areas with a long history of feral swine may have incorporated feral swine into tribal culture and may wish to retain feral swine populations while minimizing potential adverse environmental impacts. Some Tribes may also perceive feral swine as an economic and recreational asset because they provide a low-cost source of food, hunting opportunities, and a potential source of revenue through the sale of feral swine hunts and other swine-related businesses.

Under this alternative, range and size of the feral swine population is anticipated to continue to increase nationwide. Existing resources are unlikely to cause substantial reductions or eliminate all swine from States, Territories, and Tribal land with moderate to large feral swine populations, including areas where swine have been established for a long time. However, localized reductions or elimination of local feral swine populations are possible and could impact Tribes. Eradication of feral swine in states with low and isolated populations is also possible.

Tribes in areas with a long history with feral swine may be more likely to perceive positive impacts of feral swine and favor management strategies which maintain a balance between positive and negative impacts of feral swine on tribal resources and values. However, additional feral swine population increases and range expansion may strain the ability of existing mechanisms to maintain balance between positive and negative impacts of swine. The cumulative impact of increasing feral swine populations and other environmental stressors such as climate change, other invasive species, and development may result in new concerns regarding ecosystem health and the wellbeing of native species of cultural concern. Ongoing range expansion of feral swine is likely to result in new Tribes seeking solutions to address feral swine concerns. There may also be concerns that FSDM actions may result in movement of swine to adjacent tribal lands where feral swine may not already be present and where resources to address feral swine impacts may be limited.

Federal funds to conduct work in conjunction with tribes are limited and, in all but a few instances, cooperator funding must be available before APHIS-WS conducts FSDM on tribal lands. One noteworthy exception is the cooperative FSDM project with the Mescalero Apache Tribe in New Mexico, which was established as part of the pilot project to eradicate feral swine from the State.

The APHIS-WS program currently works to include Tribes in development of state-level NEPA analyses that guide the program's damage management activities. No work is conducted on tribal lands without the written consent of the tribe. Management plans specifying the nature of the work to be done and the methods to be used are developed with the applicable landowner/manager and Tribal leaders prior to initiating work to ensure that Tribal and landowner concerns and values are addressed. Coordination with tribes also reduces the risk that FSDM actions, such as hunting with dogs and aerial shooting, do not disrupt Tribal religious practices.

Coordination and consultation with the tribes and compliance with the SHPO discussed above helps to ensure that APHIS takes tribal management objectives and issues into consideration and minimizes the risks of adverse impacts on Tribes from FSDM. Therefore, we conclude that risks of adverse impacts on tribes from FSDM actions under this alternative are low. However, potential for positive impacts from FSDM in situations where tribes are experiencing damage are limited due to financial constraints.

The cultural importance of feral swine in Hawaii and some of the Territories is an issue that was discussed in Section 3.F.2. Similar concerns exist in Guam, American Samoa, and CNMI. The State of Hawaii regulates feral swine as a game mammal, and they are managed for sustainable populations in designated public hunting areas. Under the Current FSDM Program, APHIS-WS does not remove feral swine from public hunting areas. Feral swine are removed from agricultural areas and private lands primarily where they are damaging crops, property and other resources. As with other areas, some people may object to the idea that the animals are destroyed but not donated for public food use. In Hawaii, as in most places, feral swine that are killed on private lands are offered to the landowners for their own personal use. Because of the state's management objectives, feral swine would continue to be available for public hunting and thus for cultural, religious, and ceremonial uses. However, there may be local areas where feral swine are removed and would be less abundant or not available for individuals to harvest and use on private properties. For additional discussion on the availability of feral swine to hunters see the discussion on the effects on recreation, hunting feral swine in Section 4.C.5.

<u>Humaneness and Ethical Perspectives</u>

General philosophies, approaches, and issues relating to the ethics of controlling feral swine and animal welfare perspectives are discussed in detail in Chapter 3 Section E.1.f of this DEIS. The Chapter 4 analysis focuses on the ethical and humaneness perceptions specific to the management alternatives.

Under this alternative, there would be no change to the current activities that are being conducted to control feral swine in the United States. Current perspectives on the ethics or humaneness of feral swine control activities would continue under this alternative. APHIS would continue to follow all applicable policies, guidelines, directives, and SOPs when conducting any future feral swine control.

Chapter 3 presents two general models for considering whether an action is ethical. One model reviews the ethics of a project within the context of whether the action is necessary and whether it is justified (Littin and Mellor 2005). A second model reviews the action in context of 6 major criterion (Littin et al. 2004): 1) the goals, benefits, and impacts of action must be clear; 2) the action should only be taken if goals can be achieved; 3) the most effective methods must be used to achieve goals; 4) The methods must be used in the best ways possible; 5) the goals must be assessed; 5) once goals are achieved, processes should be in place to maintain results.

**2-Factor Ethics Model (Littin and Mellor 2005)**: For this model, the question of whether an action is necessary has two components. First, is whether or not there is actually a need for FSDM. The second is whether there is actually a need to use lethal methods to address the problem. Chapter 3 provides detailed documentation that feral swine pose risks to human health and safety, and can cause substantial damage to agriculture, natural resources, and property. Based on this information and site-specific experiences, APHIS, the cooperating agencies, and other federal, state, territorial, tribal and private partners currently working with APHIS on FSDM have determined that there is a clear need to take action to reduce damage and conflicts caused by feral swine. Furthermore, the lead and cooperating agencies have reviewed and considered use of a wide range of nonlethal and lethal methods as discussed in Section B. At present, exclusive use of nonlethal methods would be insufficient to address damage concerns relating to the ongoing increases in the feral swine population. Consequently, we have determined that the proposed action, including the use of lethal methods, is necessary.

We acknowledge that this determination is, in part, subjective in nature. The determination is based on an acceptance of the idea that the needs of people (human and pet safety, property, agriculture) will, at times, have priority over any rights individual feral swine may have to exist free of manipulation or death by humans. It also is based on a general philosophy that we have a responsibility to protect native ecosystems and species from adverse impacts caused by an introduced, invasive species. Individuals who have more biocentric perspectives and who consider any harm to a living creature which may be avoided as immoral or a violation of individual animal rights may not concur with the determination that FSDM is necessary. They may feel that people created the situation and people should have to live with damage that cannot be prevented through the implementation of minimally invasive nonlethal methods. In its simplest form, people, not pigs, created the problem and the pigs should not have to pay for our errors. This interpretation is most likely in the context of damage to agriculture and property. Individuals may have more nuanced interpretations in regards to risks to human safety and impacts on natural resources. Some may share the lead and cooperating agencies' sense of responsibility for protection of native species and natural resources.

There are individuals who may believe that feral swine have been present long enough in some areas to be 'naturalized' and that ecosystems in these areas have come into balance with the feral swine populations. From this perspective, FSDM would not be perceived as necessary, or the situations where FSDM is necessary would be very limited. The primary problem with this perspective is that it assumes a relatively stable system. Feral swine populations continue to increase in density and range including in some areas where they have been present for years. Additionally, native ecosystems are subject to increasing stresses from a variety of factors including climate change, development, fragmentation and other invasive species. These impacts are likely to continue to increase over time. Consequently, the impacts of a specific feral swine population can change over time when considered in the context of cumulative impacts on the system.

Perceptions regarding whether or not one of the FSDM alternatives analyzed in this DEIS and specific FSDM methods are justified will depend, in part, on individual perceptions of the humaneness of the action. Individual perceptions of humaneness can vary depending on a range of factors discussed in Chapter 3, Section E.1.f., and can include the risk of harm to individual target animals, the nature and duration of any adverse impacts on individual animals, and the selectivity of the method (i.e., risk to non-target species).

Each of the alternatives is identical in terms of the methods that would be available to state-level APHIS-WS programs. However, unlike the Integrated FSDM Program (Alternative 2), National FSDM and Strategic Local Programs (Alternative 4), and Federal Grant Program (Alternative 5), the Current FSDM Program includes only limited resources for technical assistance to States, Territories, and Tribes on development of regulations to address feral swine conflicts. Similarly, less funding is available for research efforts to bring additional nonlethal damage management alternatives into practical use and improve the selectivity and humaneness of existing management methods under this alternative than under the Integrated FSDM Program, National FSDM and Strategic Local Projects, and the Federal FSDM Grant Program (Alternatives 2, 4 and 5, respectively). Additionally, although education and outreach on FSDM is provided by state APHIS-WS programs with some assistance from the national FSDM program, this project does not include the nationally coordinated outreach and education effort that would occur under Alternatives 2, 4, and 5. Consequently, this alternative may not be considered as humane as some of the other alternatives that provide additional resources for nonlethal FSDM strategies.

In the context of impact on individual target animals, nonlethal methods are commonly considered more humane than lethal methods. Individuals with the more biocentric perspectives discussed above would likely prefer methods such as frightening devices, repellents or fencing, and educational programs to discourage people from moving swine to create hunting opportunities. However, these methods would generally only be applicable to relatively limited areas and, except for the educational programs, would not address the issue of an increasing national feral swine population. Opinions regarding the ethics of reproductive inhibitors would be mixed, with some individuals approving of the method because it is a nonlethal strategy and others opposed because there is insufficient information regarding risks to non-target species and/or perceptions that interfering with reproduction is an unacceptable intrusion on individual animals' rights and wellbeing. In terms of selectivity, risk of adverse impacts from repellents and frightening devices are likely to be minimal, but depending on design, fencing has the potential to impact movements or cause injury or mortality in non-target animals.

Lethal methods which result in a quick, painless, and relatively stress-free death are generally preferable in terms of humaneness (AVMA 2013). For example, when using firearms as a control method, APHIS-WS personnel are trained to place shots that result in quick death and minimize pain and suffering. In this context, shooting would be considered to be among the most humane methods available, although shooting from aircraft would be considered less humane than other forms of shooting because of the potential stress to the animal during pursuit and the decreased certainty in regards to shot placement. Additionally, risks to non-target species are negligible. Foothold traps and snares would be considered undesirable and inhumane by some because of the time between when an animal is captured and its death and because of the potential to capture and injure or kill non-target animals. Implementation of Association of Fish and Wildlife Agencies Best Management Practices (BMPs), when applicable, (AFWA 2006) helps to ensure that the program minimizes the pain and suffering to individual target animals, however there are no specific AFWA BMPs for feral swine. Because the methods used are used in a highly target-specific manner, very few non-target animals are captured by APHIS-WS. Most often, non-target animals that are caught can be easily released unharmed (Sections C.1 and C.2 above). Humaneness concerns associated with pursuit with dogs include risk of injury to the dog or the feral swine and stress to swine during pursuit. Dogs would not be used to kill swine and swine located through use of dogs would be killed via gunshot. SOPs pertaining to use of dogs are provided in Chapter 2 Section G.9.

The disposition of animals lethally removed has also been identified by members of the public as a factor in considerations regarding the humaneness and ethics of FSDM. As noted above, some individuals will perceive lethal removal of animals for any reason to be an inhumane and a morally unacceptable solution. However, for other individuals, knowledge that the animals removed are put to a “good use” may impact their acceptance of lethal methods. In sport hunting, lethal removal that results in use of all or most of the animal for food, or cultural and religious purposes generally has greater public acceptance than “trophy” hunting in which only a portion of the animal is kept for display purposes. Similarly, in wildlife damage management, projects that result in animals being donated to programs which feed individuals in need are generally better accepted than programs that only result in burial or other forms of animal disposal. APHIS-WS donates animals taken during damage management efforts if permitted by state, federal, territorial, and tribal regulations and if donation can be conducted in a safe and practical manner. Unfortunately, the inspection requirements of the Meat Inspection Act make donation of feral swine for human consumption prohibitively expensive and impractical to implement in most situations. However, feral swine are offered to landowners and managers for their personal use in accordance with the Act. Although this will be considered a more appropriate disposition for the animals, concerns remain regarding diseases in feral swine that may not be encountered in commercially available meat. (See impacts on human health and safety above, Section 7).

In addition to the factors discussed above, the expected efficacy of the proposed alternatives or specific method can also impact perceptions regarding the humaneness of an action. For some individuals primarily concerned about the wellbeing of livestock and wildlife, that may be preyed upon by feral swine, and human health and safety, a FSDM alternative which is less effective in addressing the increase in the national feral swine population or local damage problems may be considered less humane than more effective alternatives. In this context, the Current FSDM Program would be less acceptable than any of the other alternatives because, although local damage problems can and are being addressed, feral swine populations and associated conflicts continue to increase nationwide.

**6 Factor Ethics Model (Littin et al. 2004)**: This DEIS clearly presents the goals and anticipated benefits of an effective FSDM program. Chapter 4 of the analysis provides details on the anticipated environmental impacts of the proposed alternatives. The efficacy of each of the alternatives and individual methods in meeting project objectives is provided in Section B above. Based on the analysis in Section B, this alternative may be less effective in meeting national project objectives than some of the other alternatives presented. This alternative would use the APHIS-WS Decision Model (Slate et al. 1992; Figure 2-1) and an integrated management approach to develop the most effective site specific management plans while minimizing adverse impacts on the human environment. Factors considered in the decision model include, but are not limited to, considerations of humaneness of individual methods and the varying philosophies regarding the need for FSDM discussed above for the 2 factor ethics model. APHIS-WS personnel are trained in the safe and effective use of FSDM methods and use these methods as humanely as possible. APHIS-WS Directives (http://www.aphis.usda.gov/wildlifedamage) and the SOPs discussed in Chapter 2 Section G provide details on measures used to address concerns regarding the humaneness of FSDM methods and measures to minimize the risk of adverse impacts from FSDM. This alternative includes no national level assessment of FSDM goals. However, the APHIS-WS Decision Model used for local projects includes monitoring and assessment of project goals and impacts with cooperators. Efficacy of FSDM efforts are also reviewed in communications between APHIS-WS state programs and relevant state, territorial and tribal regulatory agencies. Under this alternative, there are no nationally available resources to respond to reports of swine in areas believed to be free of swine to investigate swine reports in areas cleared of swine, or to investigate swine reports where no swine have occurred; APHIS-WS is entirely dependent upon resources from cooperators to respond to such reports.

In summary, when considered in context of the models above, the Current FSDM Program is ethical and humane at the local (State, Territorial, Tribal) level. However, from the perspective of the 6-factor model, at a national level, it is not as effective in meeting model criterion for an ethical program as some of the other alternatives. This is due, in part, to reduced efficacy in addressing problems with the expanding feral swine population, limited resources for some types of non-lethal management strategies (e.g., research, education and outreach, and technical assistance on local regulatory options), and reduced level of national coordination and monitoring for the program. For any individual or group who accepts the idea that feral swine are invasive species in the United States that are destructive and require control, the Current FSDM Program (Alternative 1) is likely to be acceptable or insufficient, based on knowledge about feral swine damage and values that include preservation of the environment from destruction. Groups or individuals who believe that human control of wildlife in any way is wrong are not likely to find this alternative to be acceptable. Because no changes to current approaches would be made, this alternative would also probably be unacceptable to groups or individuals who specifically object to lethal or non-lethal control of feral swine. In addition, any groups or individuals who generally object to the ethics or humaneness of current APHIS activities would be likely to continue to object to the choice of this alternative.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

<u>Cultural Resources</u>

The Integrated FSDM Program would have similar effects on cultural resources compared to the Current FSDM Program (Alternative 1)since the same methods, SOPs, and avoidance measures would be used. Increased feral swine removal, in terms of numbers of animals and geographic scope, would potentially benefit historic resources, but could also increase the potential for adverse effects by increasing the need to use on-site burial as a carcass disposal method. APHIS-WS would coordinate siting with land owners and managers, SHPOs, THPOs, and/or other cultural resource experts in accordance with Section 106. While it is highly unlikely, should it not be possible to relocate excavation or work sites to avoid cultural resource conflicts, additional compliance measures would be enacted to review and mitigate adverse effects on cultural resources. This potential would increase if partner agencies specifically request that APHIS-WS assist with protecting important historic or other cultural sites from feral swine damage; however, based on program flexibility for siting and methods, it is likely that most adverse effects could still be avoided. Local NEPA processes may be used to ensure that public involvement is considered as part of Section 106 compliance.

<u>Impacts on Tribes, Traditional Cultures, and Ceremonial Values</u>

Under this alternative feral swine populations are expected to decrease nationwide, with swine populations eventually eliminated from most states except those where the State or Tribe does not desire to eradicate feral swine and/or the population is of sufficient size that eradication is unlikely given current technology and resources (Section 4.C.2). In states where feral swine populations are retained, there would likely be increases in FSDM projects to protect sensitive resources and associated increases in the number of areas within the state where local feral swine populations are reduced or eliminated. Additional resources would be available to assist tribes seeking to reduce feral swine damage.

Impacts of FSDM on Tribes would be similar to the Current FSDM Program (Alternative 1), but they would have an increase in magnitude and scope. APHIS-WS would obtain necessary authorization from Tribes and develop work plans for tribal lands in the same manner as for the Current FSDM Program (Alternative 1). APHIS-WS would conduct additional outreach activities to inform tribes of APHIS-WS' increased capacity to form partnerships to address feral swine damage with tribes, and to offer additional opportunities for consultation on tribal concerns pertaining to FSDM. One of the objectives for the FSDM program is to work with States, Territories, and Tribes to address feral swine damage in a manner consistent with their objectives for the species. The policy of working in accordance with the management objectives of States and Tribe should enable Tribes to maintain the positive values of feral swine if they wish while also reducing feral swine damage. State goals to eradicate swine could lead to potential conflicts with a Tribe or Tribes in the area that wish to retain feral swine for their use. The consultation and outreach opportunities should enable APHIS-WS to identify areas where this type of conflict may occur and work with the affected parties to identify effective solutions.

Under the Integrated FSDM Program in Hawaii and the Pacific territories, where feral swine have traditional importance, feral swine would be removed from more areas and would be subject to more intensive and focused removals of ongoing projects. New areas of focused work in Hawaii would include natural protected areas with the purpose being to assist state agencies and other entities with conservation work as they attempt to protect and restore native habitats. Restoring and protecting native plants and habitats may provide benefit for other traditional values. As under the Current FSDM Program (Alternative 1), feral swine would not be removed from public hunting areas, and there would continue to be a sustainable feral swine population as discussed in Section 4.C.1., which would be available to hunters and thus available for traditional and ceremonial uses. APHIS-WS would continue to offer feral swine that are killed on private properties to the landowners for their personal use, which may include traditional uses. Overall, more feral swine would be removed from the state than under the Current FSDM Program (Alternative 1) and this would reduce their potential availability in some areas outside of public hunting areas. Compared with the

Current FSDM Program (Alternative 1), there may be additional localized impacts based on reductions or eliminations of local feral swine populations.

Humaneness and Ethical Perspectives

**2- Factor Ethics Model (Litton and Mellor 2005)**: In addition to the agency and cooperator determinations that FSDM is necessary, Congress, through appropriation of funds for FSDM has determined that development of a national FSDM program of some sort is justified based on the scope of the problem and the need for action.

Perceptions of the humaneness of specific FSDM methods remain as presented for the Current FSDM Program (Alternative 1); however, they may be heightened based on increased operational work and program objectives. This alternative will substantially increase the number of feral swine removed using lethal methods and will likely be considered undesirable by people primarily concerned about the fate of individual animals. The increase in funds may enable APHIS-WS to access more efficient or effective methods, which are not currently available, or are limited, because of costs. For example, additional funding may enable APHIS-WS state programs to invest in remote monitoring and activation systems for cage traps, or those programs may be able to use aircraft to conduct surveillance for and remove feral swine. These shifts may impact individual perceptions of the humaneness of the FSDM program. However, under this alternative, additional funds would also be available for research on feral swine damage and damage management methods, which can be used to make existing methods more effective and selective. The availability of additional funds for research will likely facilitate investigations into reproductive control methods and toxicants that are already occurring under the Current FSDM Program (Alternative 1). Most people are likely to perceive an effective and selective reproductive control method as more humane than current lethal methods or toxicants. As discussed for the Current FSDM Program (Alternative 1), individual perceptions of the humaneness of toxicants will be varied and will depend on personal perspectives on the issue of lethal control, the need for FSDM, and perceptions of toxicants in general.

This alternative also increases APHIS technical assistance to States, Tribes, and Territories regarding development of state, territorial, and tribal regulations to discourage behaviors that contribute to the feral swine problem. Funding will also be available for a nationally-coordinated education and outreach effort to inform the public of the impacts of feral swine, the need for FSDM, and things the public can do to help address the feral swine problem.

**6-Factor Ethics Model (Littin et al. 2004)**: As noted for the Current FSDM Program (Alternative 1) the DEIS presents the goals and anticipated benefits of FSDM and provides details on the anticipated environmental impacts of the proposed alternatives. This alternative would be the most effective in meeting the combined need to address the national-level increase in the feral swine population and associated damage and the need to address local damage conflicts. As with Alternatives 1, 3,and 4 this alternative would use the APHIS-WS Decision Model (Chapter 2, Section C) to develop the most effective site specific management plans while minimizing adverse impacts on the human environment. Unlike the Current FSDM Program (Alternative 1), this alternative includes a formal process for assessing program efficacy in meeting project objectives. In addition to research on FSDM methods, this alternative may include research on methods to assess the efficacy of FSDM programs. National-level resources would be available to help APHIS-WS state programs respond to reports of swine in areas believed to be free of feral swine and in areas cleared of feral swine by FSDM.

In summary, when considered in the context of the models above, this alternative is likely to be the most ethical and humane alternative under consideration because it has the greatest probability of meeting project objectives and combines the ability to provide local assistance with national coordination in reducing the range and size of the feral swine population. It also provides national support for program components that may help reduce the need for lethal methods over the long term (e.g., education and research). If this alternative is selected, depending on the other agency partners and organizations that participate, issues relating to ethics and humaneness may require further discussion among the partners at the APHIS-WS state program level. If any of the agency partners and organizations have specific guidance they follow to address these issues, they may be incorporated into their respective projects.

***c. Alternative 3: Baseline FSDM Program***

Cultural and Historic Resources

The Baseline FSDM Program would provide additional funding to States, Territories, and associated Tribes with high feral swine populations, thus the potential for adverse and beneficial effects may be higher than the Integrated FSDM Program (Alternative 2). Conformance to SOPs for coordination with land managers, SHPOs, THPO/tribes, and other experts would help to identify and avoid potential conflicts, and Section 106 procedures would be followed similar to the Current and Integrated FSDM Program (Alternatives 1 and 2, respectively). As discussed in Section 4.C.1, this alternative may ultimately be less effective or take longer to eliminate feral swine from states with low or moderate populations. Overall, compared with the Integrated FSDM Program (Alternative 2), this alternative may protect cultural resources more in the short term, where baseline funding was provided. Long term, however, without the support of national level projects to create more efficiencies, and without strategic local level projects to target certain local populations, this alternative is likely to be less effective in eliminating feral swine and thus less effective over time at reducing damages to historic resources than the Integrated FSDM Program (Alternative 2).

<u>Impact on Tribes, Traditional Cultures, and Ceremonial Values</u>

This alternative differs from the Integrated FSDM Program (Alternative 2) primarily in the distribution of FSDM activities and the long-term impacts on feral swine populations and damage. Under this alternative, all FSDM funds would be distributed to APHIS-WS State and Territorial programs for baseline damage management and only limited funds would be held for national coordination. No funds would be withheld for national priority projects including disease monitoring, research, international coordination, or national outreach and education programs. Fund allocation would be based on the size of the swine population in the state. For States and Territories and associated Tribes with high feral swine populations, this could potentially mean that additional resources would be available to work with these entities to reduce damage by feral swine. Increases in FSDM funding would be most likely in States and Territories which did not have a goal of eradicating feral swine damage because, under the Integrated FSDM Program (Alternative 2), these states would only qualify for baseline funding and potentially some funding for strategic local projects.

As discussed in Section 4.C.1, this alternative may ultimately be less effective or take longer to eliminate feral swine from states with low or moderate populations, which could adversely affect Tribes in these areas who wish to eliminate feral swine and associated damage. APHIS-WS programs in States which would have been identified as priority candidates for feral swine eradication under the Integrated FSDM Program (Alternative 2) may receive more money for baseline damage management, but less total funding because they would not be receiving national priority program funds for swine eradication. Provisions for outreach and consultation with tribes would be the same as for the Integrated FSDM Program (Alternative 2), and requirements for authorization to work on tribal lands would remain the same as for the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively).

The management objectives for Hawaii and the Territories with feral swine are to manage for sustainable feral swine populations while also minimizing local damage and conflicts with feral swine. Consequently, as noted above in the discussion for tribes, additional funds may be available for baseline damage management in these areas. Magnitude and intensity of feral swine removals and other damage management efforts would likely be highest for this alternative. New areas of focused work in Hawaii would include natural protected areas and the purpose would be to assist state agencies and other entities with conservation work as they attempt to protect and restore native habitats. All other facets and impacts of increased FSDM activities would be as described for the Integrated FSDM Program (Alternative 2).

Humaneness and Ethical Perspectives

**2- Factor Ethics Model (Litton and Mellor 2005)**: Assessment of the necessity of the Baseline FSDM Program would be similar to that stated for Alternative 2. This alternative would increase the amount of funding available to APHIS-WS state programs to conduct FSDM. Because this alternative allocates the most resources to operational FSDM, it is likely to include lethal removal of more feral swine than any of the alternatives under consideration. This alternative will substantially increase the number of feral swine removed using lethal methods and will likely be considered undesirable by people primarily concerned about the fate of individual animals. The increase in funds may enable some APHIS-WS programs to access more efficient or effective methods which are not currently available, or are limited, because of costs. These shifts may impact individual perceptions of the humaneness of this alternative.

This alternative would not provide increased funding for research, or outreach and education programs, or national coordination regarding technical assistance for state, territorial, and tribal governments who are developing feral swine regulations. Overall, research into new methods would be similar to the Current APHIS FSDM Program (Alternative 1). National involvement in outreach and education and technical assistance would also be similar to the Current FSDM Program (Alternative 1), but, APHIS-WS state operational programs may choose to allocate some of their operational funding to increase their education and outreach programs and technical assistance on regulatory issues.

Based on the analysis in Section B above, this alternative would likely be less effective in addressing national project objectives than the Integrated FSDM Program (Alternative 2), but it would provide increased assistance for local damage management projects for some States, Territories, and Tribes. For individuals primarily concerned about the fate of individual feral swine, the potential for lethal removal of the greatest number of feral swine of any of the alternatives, and the lack of national funding for increased research, outreach and education, and technical assistance on regulatory issues may result in the ranking of this alternative as less humane than the Current FSDM Program (Alternative 1). Individuals who are concerned about the need to reduce adverse impacts of swine may rank this alternative as intermediate to the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively).

**6-Factor Ethics Model (Littin et al. 2004)**: As noted for the Current FSDM Program (Alternative 1) and the Integrated FSDM Program (Alternative 2), the DEIS presents the goals and anticipated benefits of FSDM and details the anticipated environmental impacts of the proposed alternatives. This alternative would be less effective in meeting the combined need to address the national-level increase in the feral swine population and associated damage and the need to address local damage conflicts than the Integrated FSDM Program (Alternative 2), but more effective than the Current FSDM Program (Alternative 1). This alternative would not have the same potential to benefit from increases in research to improve the selectivity and efficacy of FSDM methods as the Integrated FSDM Program (Alternative 2). There would be the same formal process for assessing program efficacy in meeting national and local project objectives as the Integrated FSDM Program (Alternative 2), but national funds would not be available for research into improved methods for assessing project efficacy. Like the Current FSDM Program (Alternative 1), no national resources would be available to help APHIS-WS state programs respond to reports of swine in areas believed to be free of feral swine or in areas cleared by FSDM.

In summary, from the agency perspective, when considered in the context of the models above, this alternative would be an improvement over the Current FSDM Program (Alternative 1), but less desirable than the Integrated FSDM Program (Alternative 2). This determination is based on the improvement in capacity to address feral swine damage at the local level and the improvement in monitoring of national program impacts, but the lack of or only minimal increase in research, outreach and education and technical assistance on local regulatory alternatives. As with the Integrated FSDM Program (Alternative 2), if this alternative is selected, issues relating to ethics and humaneness may require further discussion among the partners at the APHIS-WS state program level. If any of the program partners have specific guidance they follow to address these issues, they may be incorporated into their respective projects.

### *d. Alternative 4: National FSDM and Strategic Local Projects*

<u>Cultural Resources</u>

This alternative would not provide baseline capacity funding for states with feral swine. Consequently, some States, Territories, or Tribal lands with high feral swine populations, and/or which do not intend to eradicate feral swine populations (Appendix D, Table 2), may not receive any funding for additional operational work. In those cases, potential FSDM adverse effects on cultural resources would be similar to the Current FSDM Program (Alternative 1). Where states receive funding for national projects, focused, intensive operations would be implemented to eradicate feral swine; there, benefits to cultural resources may be realized and project Section 106, of the NHPA, consultations to address potential adverse effects on historic resources may be necessary. In the case of strategic local projects, efforts would be focused on small or new populations and therefore operations and effects would be more focused and limited in terms of geographic scope and the potential for disturbance to cultural resources. Benefits to these cultural resources would be based on the level of existing and potential feral swine activity.

Because this alternative would apply more funding to national projects (e.g. research, national-level education and outreach, and materials) than any other alternative, it would likely provide beneficial effects based on long-term efficiency, efficacy, and ultimate success of FSDM. Most types of national projects would not have the potential to cause adverse effects on cultural resources so would not require further Section 106 consultation. Long term benefits to cultural resources (from removing damaging feral swine) would be based on the efficiency and efficacy of FSDM with emphasized national support.

<u>Impacts on Tribes, Traditional Cultures, and Ceremonial Values</u>

Under this alternative, all FSDM funds would be allocated to national projects intended to stabilize and eventually reduce the size and distribution of the feral swine populations in the U.S. and strategic local projects. No funds would be available for baseline damage management. Consequently, APHIS-WS state programs which are not identified as priorities for FSDM would, at most, only receive funds for strategic local projects until such time as the national feral swine population management objectives are met and funds are re-allocated to address remaining local damage management needs.

As discussed in Section 4.C.1, this alternative may be able to stabilize and eventually reduce the range and overall size of the feral swine population more quickly than under the Integrated FSDM Program (Alternative 2) which would be beneficial to Tribes in these areas who wish to eradicate swine. Adverse effects of swine eradication on tribes in these areas would be similar to, but occur more quickly, than under the Integrated FSDM Program (Alternative 2). Less funding is likely to be available to assist tribes with FSDM in states which are not identified as national priorities for FSDM, although funds for strategic local projects may be available to tribes to protect important cultural resources and sites. Provisions for outreach and consultation with tribes would be the same as for the Integrated FSDM Program (Alternative 2), and requirements for authorization to work on tribal lands would remain the same as for the Current and Integrated FSDM Programs (Alternatives 1 and 2, respectively).

Hawaii and the Territories with feral swine are managing for sustainable feral swine populations and to address local damage and conflicts with feral swine. Funds for FSDM in these areas would be limited to strategic local projects intended to protect sensitive species and high priority conservation areas. The overall increase in FSDM and associated positive and negative impacts would be greater than the Current FSDM Program (Alternative 1), but less than the Integrated FSDM Program and Baseline FSDM Program (Alternatives 2 and 3, respectively). All other facets and impacts of increased FSDM activities and associated SOPs would be as described for the Integrated FSDM Program (Alternative 2).

Humaneness and Ethical Perspectives

**2- Factor Ethics Model (Litton and Mellor 2005):** Perceptions of the ethics and humaneness of this alternative would be similar to those described for the Integrated FSDM Program (Alternative 2). Assessment of the necessity of a national FSDM program would be similar to that stated for Alternative 2. Some states and territories which are lower priority in terms of achieving national feral swine population control objectives may not receive any FSDM funding or only limited funding for strategic local projects in the early years of the program. Consequently, some people may consider this alternative less desirable because it provides reduced assistance for local FSDM and is less humane to animals and people negatively impacted by feral swine damage in the low priority areas. Others may consider the increase in capacity to achieve national feral swine population management goals to be more important than the short term reduction in funding for operational FSDM in states and territories which are not identified as priorities for national feral swine population management. This alternative may be considered preferable to Alternative 3 because it includes nationally coordinated education and research efforts which may help decrease the need for lethal methods over the long term.

**6-Factor Ethics Model (Littin et al. 2004):** As noted for the Current FSDM Program (Alternative 1) and the Integrated FSDM Program (Alternative 2), the DEIS presents the goals and anticipated benefits of FSDM and details the anticipated environmental impacts of the proposed alternatives. This alternative would be less effective in meeting the need to address local damage and conflicts in low priority states than Alternatives 1 – 3. However, this alternative would be equal or greater in effectiveness in meeting the need to address the national-level increase in the feral swine population and associated damage as Alternatives 1-3. There would be the same formal process for assessing program efficacy in meeting national and local project objectives as Alternative 2 and 5 including research into improved methods for assessing project efficacy.

In summary, from the agency perspective, when considered in the context of the models above, this alternative would be an improvement over the Current FSDM Program (Alternative 1), but less desirable than Integrated FSDM Program (Alternative 2). This determination is based on the improvement in capacity to address feral swine damage at the national level and the improvement in research and education. However, some areas would receive less support for local FSDM until such time as populations are controlled or eradicated in higher priority states and territories.

As with the Integrated FSDM Program (Alternative 2), if this alternative is selected, issues relating to ethics and humaneness may require further discussion among the partners at the APHIS-WS state program level. If any of the program partners have specific guidance they follow to address these issues, they may be incorporated into their respective projects.

### *e. Alternative 5: Federal FSDM Grant Program*

Cultural and Historic Resources

APHIS-WS would not directly affect cultural resources under this alternative, but it would still be responsible for NHPA compliance as the grantor of funding depending upon agreements with other federal agencies that may be grant recipients. Adverse effects on cultural resources could be avoided similar to the other alternatives considered, and while APHIS-WS would be responsible for monitoring program effects, the ultimate effect would be related to the degree that grant recipients followed protocol established for resource protections. Overall, because less funding would equate to less operational FSDM, benefits to cultural resources from feral swine removal would be greater than the current FSDM Program (Alternative 1), but lower than under the other alternatives. Whether or not this alternative might provide more benefits than the Current FSDM Program (Alternative 1) would depend largely on the efficiency of grant recipients who deliver FSDM services. This alternative is not likely to provide as much potential benefit to cultural resources that are harmed by feral swine because fewer feral swine would likely be eliminated locally and on a state/territory scale.

Impacts on Tribes, Traditional Cultures, and Ceremonial Values

Like the Integrated FSDM Program (Alternative 2), this alternative substantially increases the level of FSDM that would be conducted. This alternative would fund most of the same types of projects as under the Integrated FSDM Program (Alternative 2), but the work would be conducted by States, Territories, Tribes, Universities and other entities working under grants from APHIS. Less FSDM would be conducted under this alternative than under the Integrated FSDM Program (Alternative 2), because of the inefficiencies in the alternative discussed in Sections 4.C.1 and the Economic Impacts section below. States, Territories, Tribes and Research Institutions would be able to submit requests for grants to conduct research; disease monitoring; and baseline, national priority, and strategic local FSDM projects. Application requests for projects involving partnerships among agencies and tribes would be encouraged. Under this alternative, because APHIS-WS would not be conducting operational FSDM, or disease monitoring or research, APHIS-WS would not have the capacity or direct involvement in FSDM at the local level to support provisions for coordination and consultation with the tribes established for Alternatives 2-4. Coordination with affected Tribes would be a condition of the grants, and Tribes could submit applications on their own. However, some Tribes may be concerned that fair treatment and access to resources may be more difficult when working with Territories and States than when working with a federal agency with a commitment to engaging the Tribes in management and decision making (See Executive Order 13175 Consultation and Coordination with Indian Tribal Governments and APHIS Directive 1030.3 Relationships with Native Americans and Tribal Governments).

Hawaii and the Territories generally manage for sustainable feral swine populations in at least a portion of the lands under their jurisdiction to accommodate recreational and/or traditional uses and values. Local eradication and/or damage management may occur in some areas including all or portions of National Parks and National Wildlife Refuges to protect sensitive species and ecosystems. As with tribes noted above, Native Hawaiian organizations and organizations representing native people in the Territories would be able to apply for FSDM grants in cooperation with the State and Territories or for their own projects to balance the positive and negative impacts of feral swine.

<u>Humaneness and Ethical Perspectives</u>

This alternative would contain the same components as the Integrated FSDM Program (Alternative 2), so ethical and humaneness considerations for this alternative would be similar. The primary difference is that less funding will be available for all facets of FSDM (operational management, research, education and outreach, and technical assistance) because of the costs of administering and monitoring the grant program. Based on the analysis in Section 2 above, there will also be some inefficiencies inherent in this alternative that would likely make it less effective in meeting national and local project objectives than the Integrated FSDM Program (Alternative 2). Consequently, some individuals may consider this alternative less desirable from an ethics perspective than the Integrated FSDM Program (Alternative 2).

## 9. Economic Impacts

This section provides a review of the economic costs and benefits of the FSDM alternatives. Case studies assessing damage to specific components of the affected environment are provided in Chapter 3. Information regarding the costs and relative efficiency of individual FSDM methods are included in the evaluation of the efficacy of the alternatives in Chapter 4, Section C.1.

### *a. Alternative 1: Current APHIS FSDM Program (No Action Alternative)*

Under this alternative, APHIS-WS has been conducting wildlife damage management to address local and/or state level concerns on a case-by-case basis. Although effective in addressing local issues, nationwide, the feral swine population and associated costs from damage and risks to human and animal health is increasing (Chapter 3). Current APHIS FSDM efforts lack the national-level coordination and strategic allocation of resources needed for long term large scale management of damage. Biologists with state programs opportunistically collect samples from feral swine for disease monitoring, which is coordinated nationally through the APHIS-WS National Wildlife Disease Program, but there is only limited use of targeted sampling to monitor for diseases of national concern. However, some targeted sampling may occur for projects funded by cooperating agencies and research institutions, including NWRC, depending upon the availability of funds. National and state level outreach and education programs are conducted within the constraints of available resources.

In the absence of specific allocations for FSDM, APHIS-WS uses general appropriated funds for state and NWRC operations. In FY12, APHIS-WS spent $2,604,620 in appropriated funds for FSDM (Table 4-5). Cooperators provide additional funding for FSDM. In FY12, approximately half the total funding for FSDM ($2,773,000) was provided by cooperators. Cooperators may also provide support in the form of staff to assist with work, or provide facilities and equipment for APHIS-WS use.

**Table 4-5.** FY12 Funding for APHIS-WS FSDM Activities.

| Wildlife Services | Appropriated Funding FY12 | Cooperative Funding FY12 |
|---|---|---|
| Eastern Region | $50,000 | $1,019,928 |
| Western Region | $1,187,000 | $1,559,539 |
| National Wildlife Research Center | $1,367,620 | $193,489 |
| **Total** | **$2,604,620** | **$2,772,956** |

The dependence upon cooperator funding limits the ability of APHIS-WS to work to limit feral swine populations and provide long term solutions to feral swine damage. Efforts to manage damage and eradicate or substantially limit feral swine populations require working with multiple landowners/managers. However, not all of these landowners/managers may be willing or able to contribute to the funding needed to address feral swine on their property. At present, APHIS-WS ability to assist low income landowners and communities is primarily limited to what can be accomplished with funding from other agencies and cooperators with a shared interest in managing feral swine and swine damage on a larger scale than the individual properties under their management.

Feral swine are fast breeders and resilient survivors. These characteristics make them extremely troublesome pests. But their large and growing population, high level of adaptability, and favorable game meat characteristics make them popular targets of recreational hunters and individuals seeking supplemental food. Businesses have been created or enhanced in response to the opportunities that feral swine hunting present, although their total number is not known. These businesses include feral swine hunting guides and excursions, FSDM services, and businesses which provide supplies for FSDM. Landowners with free-ranging swine on their property may also sell hunting opportunities.

Hunting (all species combined) contributes substantially to the United States economy. According to a 2012 study, there are 13.7 million hunters in the United States. In 2011, $38.3 billion was spent on hunting supplies, equipment, and other costs. Hunting by individuals supported 680,000 jobs in the United States and generated $11.8 billion in tax revenues (Southwick Associates 2012). The portion of the overall industry impacts attributable to feral swine hunting has not been determined. Of the States and Territories that responded to an informal APHIS questionnaire in 2013, 33 explicitly allowed the hunting of feral swine, while 14 did not. Thirty-five States had codified restrictions on the hunting of feral swine, including 19 that have some licensing requirement. Sixteen States have essentially no restrictions on the hunting of feral swine. Feral swine damage to other game species is expected to grow as their populations persist and expand. Thus, the economic benefits from feral swine hunting would have the reverse effect on revenues generated in other hunting pursuits since feral swine adversely affect a number of other important game species through predation, competition, displacement, and habitat damage.

Twenty-six States have hunting preserves that include hunting feral swine. These preserves are not affected by the Current FSDM Program because of its limited effects on feral swine populations. Similarly, 24 States allow the selling of feral swine hunts on private land, with variation among the States in restrictions on the use of fences.

The number of businesses involved in private feral swine control is unknown and difficult to quantify. As an example though, the Louisiana Department of Wildlife and Fisheries maintains a list of private operators involved in pest control in the State. Louisiana, which has a high population of feral swine that damage sugar cane and other crops as well as levees and lawns, has 146 registered private wildlife control operators in its database. Of these, 104 do not specifically exclude feral swine as a species for which they are willing to provide pest control services. Sixteen of the operators specifically mention feral swine as a specialty. These figures are not necessarily comprehensive, nor can they be generalized to all States with a feral swine population, but they are indicative of the potential number of businesses that currently see some economic benefit from the existence and spread of feral swine (LWLF 2014).

Those who benefit from feral swine related businesses are not likely to be adversely affected by current feral swine removal rates since populations are generally continuing to expand in most areas.

***b. Alternative 2: Integrated FSDM Program (Preferred Alternative)***

Under this alternative, the proposed feral swine program would be funded through an annual congressional appropriation for the APHIS-WS program. Current appropriations are anticipated to be $20 million per FY. Under this alternative, APHIS-WS funding would be used to improve baseline damage management response capacity in all states with feral swine (e.g., funding for personnel and to supply FSDM equipment such as cage traps); provide increased funding and support for states identified as priorities to meet the national goal of eradicating feral swine populations in all areas where populations are limited or newly established; outreach and educational programs and materials; research; national disease monitoring; and international project coordination. APHIS-WS appropriations are not intended to provide all the money needed for FSDM. Instead, APHIS-WS funds would be combined with funds from agency partners, tribes, organizations, and individuals in cost share programs and other partnerships to provide for a more effective and comprehensive program than any one entity could provide on its own. The extent to which APHIS-WS funding would be met or even exceeded by funding from cooperating entities is unclear, but is anticipated to be similar to other APHIS-WS programs. Nationwide, in FY13 approximately 69% of APHIS-WS funding came from cooperators, with cooperator funding ranging from 16% to 100% of individual State or Territory program funds (APHIS-WS Program data reports; http://www.aphis.usda.gov/wildlifedamage).

Congressionally appropriated funds can vary among years as can cooperator contributions to program actions. The program objective of eradicating feral swine populations in all areas where populations are limited or newly established, and the Federal, State, territorial, or tribal entities that are working to eradicate swine is expected to take years to accomplish (Chapter 4 Section C.1). Increases in funding are likely to reduce the time needed to achieve project objectives. Relatively minor decreases in funding would be spread across all projects and would likely increase the amount of time needed to achieve project objectives. Larger-scale decreases would result in eventual omission of strategic local projects, reductions in baseline and national program funding and eventual consolidation of funds to States, Territories, and Tribes of greatest strategic importance for project objectives. Work could continue to be conducted in other areas if cooperator funding is available as under the Current FSDM Program (Alternative 1).

Feral swine are highly adaptive and fast breeders, and therefore, the resources required to eliminate an emerging population grow exponentially the longer a response is delayed. However, some increases in difficulty and expense are expected in the last stages of swine eradication from an area because of the challenges in locating and removing the last few animals. This alternative systematically applies available resources to eradication of swine in strategically identified areas while also providing baseline assistance to all areas with feral swine. This strategy should help stabilize feral swine populations and associated damage and protect particularly sensitive areas and species in areas which are not immediately targeted for feral swine population eradication because of resource limitations. This alternative would also allow for significantly more robust emergency response to newly discovered populations of feral swine in States previously considered to be free. Robust and rapid emergency response to newly established populations may require more resources in the short term, but the long-term benefits of eliminating a new population early and minimizing future prolonged damages would be substantial.

Under this alternative, APHIS would have substantially increased resources to use for FSDM and to use to establish cost-share partnerships to increase the collective capacity of agencies, Tribes, and landowners, and managers to address feral swine damage. Under this alternative, APHIS-WS would have increased capacity to conduct FSDM in areas where landowners and communities are unable to provide all the funding needed for FSDM. Consequently, APHIS-WS would have greater ability to conduct effective large scale damage management or feral swine population eradication efforts across multiple land ownerships without some of the funding obstacles. However, challenges inherent with working with individuals who may have differing feral swine management objectives would remain.

In contrast to the Current FSDM Program (Alternative 1), the proposed FSDM features closer cooperation with Canada and Mexico. Coordinating efforts with these two countries would increase the likelihood of successfully controlling feral swine populations and migrations along our borders. Projects near the borders could be rendered moot if the feral swine populations roam freely from one country to the other. Attempts to eliminate small populations near country borders could prove to be the most costly (per head) operation, and ultimately unsuccessful if such populations can be reestablished by cross-border migrations. Cooperation with Canada and Mexico would also enhance the tracking and monitoring of populations not targeted for near-term elimination. Data generated from such cross-border efforts would contribute to the success of the program as a whole.

Increased research on feral swine management and removal methods supported under this alternative has the potential for positive long-term economic impacts through increases in efficiency and efficacy of program activities. A breakthrough in chemical control methods, in particular, would significantly impact efforts to manage feral swine populations.

Education and outreach efforts can help discourage behaviors which contribute to the feral swine problem (e.g., moving swine), and aid development of effective regulations to address/prevent establishment of feral swine and associated damage. Combined with operational management and international coordination on swine management, effective research and outreach can help reduce the long term costs of FSDM.

This alternative also provides for national monitoring and evaluation of program performance. The resulting data would yield much-needed comprehensive and accurate performance baseline for making project management decisions. Efficiency gains would likely be small initially, but would rapidly grow as monitoring and evaluation data are gathered and analyzed and the program is adjusted accordingly.

Under the Current FSDM Program (Alternative 1), approximately 30,000 pigs are eliminated each year. The number of feral swine eliminated or contained under this alternative would vary depending on where the operations take place, the specific program objective in each area, the phase of the operation, or the extent to which elimination or containment in each of the areas has been achieved. Smaller populations and populations that have been heavily exploited are more costly to eliminate. Greater numbers of feral swine can more easily be removed from larger populations without affecting the population. For the purpose of comparing alternatives based on program efficiencies, taking the elimination of a range of 70,000 to 100,000 feral swine as an illustrative estimate of the number of swine which might be removed annually under this alternative, and assuming the commonly cited figure of $200 in crop damage per feral swine per year (adjusted to $235 per year in 2012 dollars), the this alternative could result in an additional $9.4 to $16.4 million in avoided crop damages over current program levels (Table 4-6). Some experts believe the $200 of crop damage per feral swine is conservative and the level of avoided crop damages would be substantially higher (M. Bodenchuk, pers. com. 2014).

**Table 4-6** - Illustrative differences between the Current and Integrated FSDM Program (Alternatives 1 and 2). Estimate of feral swine taken under the Integrated FSDM Program (Alternative 2) is an estimate for purposes of comparison only. Actual number of swine taken per year under the Integrated FSDM Program (Alternative 2) could be higher or lower depending upon the relative density of swine in project areas and the stage of the project. More effort is generally needed per swine to remove the last few animals from a population than to remove animals from areas with high populations.

| | **Alternative 1 – Current FSDM Program** | **Alternative 2 – Integrated FSDM Program** |
|---|---|---|
| Number of feral swine assumed to be eliminated per year | 30,000 | 70,000 to 100,000 |
| Agricultural damage costs prevented by removing swine.[1] | $7,050,000 | $16,450,000 to $23,500,000 |
| Emergency response to new populations in otherwise feral swine-free States | Very limited capacity. Relies on cooperator initiation and funding. | Yes. Resource allocation for emergency response would be provided based on national and strategic local projects. |

| | | |
|---|---|---|
| Research | NWRC ongoing | Increased development of new control and monitoring technology |
| Partnering with Canada and Mexico | No | Coordinate with Canada and Mexico to address feral swine along borders |
| Funding prioritization for removals. | No national funding. Priorities largely established by requesting agencies and others. | National projects would focus on systematically eliminating feral swine from key states. Baseline programs would fund damage management in all States with feral swine, with levels dependent upon feral swine population levels. Strategic local projects would focus resources in specific areas to help achieve national goals. |
| Evaluation and monitoring | Monitoring for operations is conducted at the APHIS-WS State level for compliance with NEPA and all regulatory and policy requirements. Feral swine population monitoring is either not done, or is done opportunistically based on cooperator funding. | APHIS would monitor program adherence to conditions specified in the EIS, Record of Decision (ROD). Population monitoring is included under this alternative. APHIS would also develop performance measurements that are consistent with long-term strategic goals and objectives. Program monitoring and performance reports would guide and refine management practices in accordance with adaptive management practices. |

[1] (assumes $235/swine in 2012 dollars)

Feral swine sport hunting excursions, FSDM businesses, private pest control operators, and individuals who use feral swine for supplemental food in areas where feral swine populations are eliminated or substantially reduced could be negatively impacted in the long term by a national feral swine control program. Hunters in these areas who wish to continue to hunt swine are likely to incur greater costs to travel to other areas with free ranging swine or pay for hunting opportunities in fenced preserves. Impacts may be greatest in the States, Territories, and Tribal lands which do not require licenses or regulate harvest of animals which may be taken because there are no regulatory costs associated with feral swine hunting or limits on the number of swine which may be removed. On the other hand, FSDM in areas affected by the program would support hunters and associated business that utilize other game species that are or would have been adversely affected by feral swine. Thus, the adverse effects on these businesses may be reversed where revenues can be generated in hunts for other game animals such as wild turkey, other ground nesting birds, and deer since predation pressure, competition, displacement, and habitat damage from feral swine would be reduced and in many areas would be eliminated.

Impacts of increased agency efforts to reduce or eliminate feral swine populations on businesses which provide damage management supplies (e.g., cage traps) would vary over time. Initially, these businesses may benefit from agencies increasing FSDM efforts. Over the long term, success in limiting the feral swine population would limit business opportunities.

In areas where the State/Territory/Tribe is working to eliminate or substantially reduce the feral swine population, hunting preserves and farmers raising swine in pastures may have increased requirements for fencing and monitoring to ensure that swine do not escape. Some States, Territories, and Tribes may seek to limit or eliminate hunting preserves as part of efforts to reduce or eliminate feral swine populations. Conversely, reduction or elimination of State, Territorial, or Tribal feral swine populations may benefit fenced hunting preserves in areas where these facilities are still permitted because of increased business from individuals who had hunted free-ranging feral swine, or because they can increase the price of hunts in the absence of free or low cost opportunities to hunt feral swine. State, Territorial, and Tribal regulation of these entities varies significantly, and the impacts of a national control program would similarly vary depending on the locale.

### *c. Alternative 3: Baseline FSDM Program*

Like the proposed Integrated FSDM Program (Alternative 2), this alternative would be funded through an annual congressional appropriation for the APHIS-WS program. Under this alternative, all FSDM actions would be committed to baseline program activities based on the number of swine in the State, Territory or Tribal areas. No funds would be allocated for strategic local projects, nor would there be funding for national program activities including targeting specific states for swine eradication, research, national outreach and education efforts, nationally coordinated disease surveillance, additional aircraft, or nationally directed coordination with Canada and Mexico. Some of these things may continue to happen to a lesser extent on the local level if APHIS-WS state directors and cooperators choose to allocate funds for these purposes in a manner similar to the Current FSDM Program (Alternative 1).

In some States, Territories, and Tribal areas, the increase in baseline funding without the national and strategic local projects may be sufficient to enable the State/Territory/Tribe to meet swine eradication goals. In areas with moderate or high populations (Figure 7), baseline funding may never be sufficient to achieve the level of removals needed to meet eradication and containment goals, or funding may not be sufficient until such time as swine are eradicated from other areas and funds are freed to support States/Territories/Tribes which still have swine. Allocation of funds based strictly on size of existing feral swine populations could cause problems because we anticipate it would take more time and effort per swine to locate and eliminate the last few swine in an area. Under the Integrated FSDM Program (Alternative 2), this dilemma is addressed through the allocation of national and strategic local funds, but it could only be addressed under the Baseline FSDM Program if the formula for allocating baseline funds is adjusted to increase funding in areas with only a few remaining feral swine.

Additionally, under this alternative, money would likely be unavailable for rapid response to new detections of feral swine in states until the next funding cycle. Delays in responding to swine detections would likely increase cost of removal efforts.

The Baseline Funding Program (Alternative 3) would also differ from the Integrated FSDM Program (Alternative 2) on the important issue of feral swine population monitoring. The Integrated FSDM Program (Alternative 2) would provide baseline funding for increased monitoring in States that have confirmed populations of feral swine. It would also provide funding for special surveillance projects at the national, State, or local level, to monitor and control emerging populations as needed. The Baseline Funding Program (Alternative 3), would lack the capacity to support these additional surveillance projects, and would only provide for expanded population monitoring in States with confirmed populations. This lower level of monitoring is more likely to result in emerging populations growing significantly before a response can be effectively executed, leading to increased control costs and reduced program efficiency.

Research activities under this alternative are likely to be similar to the Current FSDM Program (Alternative 1). Research and efforts to register new chemical methods would be substantially slowed or nonexistent under this alternative depending on alternative sources of funding. The NWRC has extensive experience in evaluation, development, and registration of toxicants and reproductive control methods for damage management. Under this alternative, the ability of the NWRC to use these skills in partnership with other research institutions would be extremely limited unless outside funding was provided by the partner institution or other cooperators.

Similarly, the Baseline FSDM Program offers significantly lower capacity for disease monitoring than the Integrated FSDM Program (Alternative 2). As described in Chapter 3 Section B.b, one of the largest potential costs of uncontrolled feral swine populations is the risk of disease transmission. Improved disease monitoring capacity is important, but Alternative 3 would not provide for any disease monitoring above that which is performed under the Current FSDM Program (Alternative 1).

Funding increases above the $20 million per year could increase the number of states and territories which receive a sufficient level of baseline funding to achieve swine eradication objectives. Relatively minor decreases in funding would be spread across the programs and would likely increase the amount of time it would take to meet project objectives. Substantial decreases in funding could result in re-allocation of baseline funds such that some states may not receive any baseline funding in some years. Work could continue to be conducted in other areas if cooperator funding is available as under the Current FSDM Program (Alternative 1).

Economic impacts of this alternative on swine hunting, hunting preserves, damage management businesses, and individuals who use swine for supplemental food would be greater than the Current FSDM Program (Alternative 1) and somewhat similar to Integrated FSDM Program (Alternative 2), but probably lower based on the difficulty of eradicating feral swine from some areas. Without National education, outreach, and technical assistance to states with assessing the efficacy of their regulations relating to feral swine, individuals may be more likely to continue to take legal and/or illegal actions to ensure that feral swine hunting opportunities continue, which would contribute to persistence of feral swine populations. Impacts would be greater in States/Territories/Tribes with large feral swine populations because these areas would receive more funding for damage management under this alternative. Impacts may be more gradual in states where swine populations are limited and eradication is desired because it may take longer to eliminate feral swine from some areas under this alternative.

Crop damages alleviated would be greater than the Current FSDM Program (Alternative 1), and could be greater at first compared with the Integrated FSDM Program (Alternative 2) since funding would not be allocated to National priorities that focus beyond immediate damage control. In the long term, efficiencies gained under that Integrated FSDM Program (Alternative 2) would make that alternative more effective at reducing crop damages, while the Baseline FSDM Program would become less efficient and effective.

Baseline programs would support hunters and associated businesses that utilize other game species that are adversely affected by feral swine. Increases in revenues over time could be generated from hunting other game animals such as wild turkey, other ground nesting birds, and deer since predation pressure, competition, displacement, and habitat damage from feral swine would be reduced. Relief from feral swine damage with associated potential increases in revenues from other game hunting expenditures are likely to be lower than the Integrated FSDM Program (Alternative 2), but greater than the Current FSDM Program (Alternative 1)

Under this alternative, the APHIS-WS state programs would have more resources to use for FSDM and to establish cost-share partnerships to increase the collective capacity of agencies, tribes, and landowners/managers to address feral swine damage. The increase in FSDM resources may enable APHIS-WS to assist in situations where the low-income individuals and communities do not have the resources to fund FSDM. This would increase the capacity of APHIS-WS state programs to aid low-income individuals and communities. However, this increase in baseline funding comes at the cost of national-level activities which would support effective FSDM program implementation on a national scale and could delay or make it extremely difficult to achieve feral swine eradication goals in some areas. As with the Integrated FSDM Program (Alternative 2), challenges inherent with working with individuals who may have differing feral swine management objectives would remain.

***d. Alternative 4: National FSDM and Strategic Local Projects***

Like the proposed Integrated FSDM Program (Alternative 2), this alternative would be funded through an annual Congressional appropriation for the APHIS-WS program. Under this alternative, program funds would only be allocated to meet the national program objective of eradicating feral swine populations in all areas where populations are limited or newly established and for strategic local projects. As these areas are cleared of swine, emphasis would be placed on States/Territories/Tribes which have a goal of eradicating swine, but which have larger feral swine populations. This alternative would not provide baseline capacity funding for all states with feral swine. Consequently, some State/Territory/Tribal lands with high feral swine populations and States/Territories/Tribes which do not intend to eradicate feral swine populations may not receive any funding or may only receive funding for strategic local projects until such time as swine are eradicated from other higher priority areas (e.g., areas with emerging, low, or isolated populations) and funds are freed to address new locations.

FSDM activities would still be conducted at the State/Territorial/Tribal level with cooperator funds. However, in general, this alternative would be less responsive to requests for local damage management assistance than the Integrated FSDM Program (Alternative 2) and the Baseline FSDM Program (Alternative 3). The advantages of a more comprehensive approach proposed under the Integrated FSDM Program (Alternative 2), including the strategic apportionment of management resources for the containment of feral swine populations in areas where they cannot be eliminated in the near term, would not be realized.

This alternative makes more funds available per year for eradication of feral swine from strategic areas than the Integrated FSDM Program and Baseline FSDM Program (Alternatives 2 and 3, respectively), and therefore, it would be to take less time to eradicate swine from locations identified as priorities for feral swine eradication efforts which would have the greatest long-term benefits of eliminating priority populations and minimizing future damages and associated control costs. Unlike the Baseline FSDM Program (Alternative 3), funds would be available for rapid response to new swine detections in State/Territories/Tribal lands without swine populations. Rapid response funds would be greater than all the alternatives, even higher than the Integrated FSDM Program (Alternative 2) since no baseline funding would be used. This would provide long-term benefits by minimizing future population expansions into new areas, thus minimizing future associated damage and control costs.

More funds would be available for research, national-level education and outreach programs and materials, national disease monitoring, and national and international project coordination than for the Integrated FSDM Program (Alternative 2) or any of the other alternatives. This would enhance long term efficiencies beyond what could occur in the Baseline FSDM program (Alternative 3) but also beyond what may be available under the Integrated FSDM Program (Alternative 2) since program funds would be used in baseline operations. However, the lack of baseline funding in areas which are not identified as priorities for eradication could hinder efforts to stabilize or reduce damage. Consequently, efforts to reduce or eliminate swine populations in these areas could be more difficult and expensive if and when these areas eventually become priorities for damage management.

Funding increases above the $20 million per year could decrease the time required to achieve national feral swine eradication and containment objectives. Relatively minor decreases in funding would be spread across all program activities and would likely increase the amount of time it would take to meet project objectives. Substantial decreases in funding would initially result in elimination of funding for strategic local projects and reduce the number of states where APHIS is working to achieve national program objectives at any one time.

Economic impacts of this alternative on swine hunting, hunting preserves, damage management businesses, and individuals who use swine for supplemental food would be greater than the Current FSDM Program (Alternative 1) and differ from the other alternatives in that it would be more focused on National priorities for elimination and for strategic local projects than the Integrated FSDM Program (Alternative 2), but would be the least likely of the alternatives to reach some areas where feral swine populations are highest. Like the other alternatives, negative effects on feral swine hunting related businesses would have a reverse effect on hunting related business for other game species that are adversely affected by feral swine.

Under this alternative, although there would be additional funding for FSDM, baseline funding would not be available for all APHIS-WS programs in states with feral swine. In some states, FSDM funds would be limited to strategic local projects. Consequently the ability of APHIS-WS to form cost-share partnerships and aid low income individuals and communities in these areas would be greater than the Current FSDM Program (Alternative 1), but less than the Integrated FSDM Program (Alternative 2) or the Baseline FSDM Program (Alternative 3). However, in States, Territories and Tribes which are identified as priorities for the feral swine removal, there would likely be more funding available than under the Integrated FSDM Program (Alternative 2) and Baseline FSDM Program (Alternative 3) because management efforts and available resources would be focused on these sites.

The number of feral swine removed, and the associated avoided crop damages would be greater than the Current FSDM Program (Alternative 1), but lower than the other alternatives in the short term since it is more costly initially to eliminate populations and since more funds would be allocated to non-operational control projects like research, education, outreach, and surveillance. However these activities would increase long term program efficiencies and increase avoided losses but probably not reach Integrated FSDM Program (Alternative 2) levels based on the difficulty in treating long-term damages in areas with larger feral swine populations.

***e. Alternative 5: Federal FSDM Grant Program***

Under the Federal FSDM Grant Program, no new FSDM funds would be available for operational APHIS-WS FSDM and the APHIS-WS program would discontinue current FSDM efforts. Like the Integrated FSDM Program (Alternative 2), this alternative would be funded through an annual congressional appropriation for the APHIS-WS program. Local entities currently providing funding to APHIS-WS for assistance with FSDM would be referred to the appropriate State, Territorial, Tribal, local, or private entity assuming the tasks currently conducted by APHIS-WS. Grant topics and approval would be set to address the same project areas as for the Integrated FSDM Program (Alternative 2). This alternative has several requirements and inefficiencies that would substantially reduce the amount of funding available for FSDM activities. APHIS-WS would use funds for the grant administration process and to monitor grant projects for project results and to ensure that grant recipients are adhering to SOPs and mitigations established by the APHIS program and adopted by the Record of Decision. This monitoring would likely take more time and effort than similar programs needed to allocate resources and monitor program actions internally. Additionally, public accountability and reporting is expected. Collating information from the various grants would take more time and effort than recording and reporting data through use of the existing APHIS-WS MIS system. It is also anticipated that grant recipients would need to use some money for overhead and project management and reporting. The ultimate result of these factors is that more money would be spent on overhead and less available for operational management than under Alternatives 2-4. This alternative would still have increased funding levels and would consequently still result in more positive outcomes than the Current FSDM Program (Alternative 1). But relative to

Alternatives 2-4, feral swine control, animal elimination, and program response would all be less successful.

We expect that Agency partners and Tribes would be capable of conducting FSDM, however, there would likely be some economies of scale which could be more readily achieved under the Integrated FSDM Program (Alternative 2) than by individual States/Territories and Tribes. Additionally, some of the activities proposed under the Integrated FSDM Program (Alternative 2) are unlikely to be conducted by State/Territorial and Tribal contractors under grants, including national-level coordination with Canada and Mexico, national-level outreach and education, and targeted national-level disease monitoring in swine. These actions could be conducted at the local level, but may not be as efficient or effective as national projects. Funding for this alternative is likely to be allocated to grant applicants at the beginning of the year, so additional funding is unlikely to be held in reserve to respond to detections of swine in areas which were previously believed to be free of feral swine, similar to the Baseline FSDM Program (Alternative 3).

Depending on local conditions, aerial shooting can be a very efficient means of locating and removing feral swine. However, aerial shooting requires specific types of aircraft and specially-trained pilots and crews. Some States/Territories and Tribes may not have access to these resources and would need to contract with experienced teams or do without the use of aircraft. Similarly, the NWRC has extensive experience in the development and registration of pesticides for wildlife damage management which would not be available for use under this alternative. Local entities such as universities could fulfill these needs, but time and money may be lost during the learning process.

In addition to less effective elimination and control of feral swine, Alternative 5 would also likely result in reduced levels of monitoring of both feral swine populations and disease prevalence, in comparison to the other alternatives. APHIS would not undertake additional monitoring; additional monitoring activities would be determined by the entities receiving funding and limited to areas under their management.

Economic impacts of this alternative on swine hunting, hunting preserves, damage management businesses, and individuals who use swine for supplemental food would be greater than the Current FSDM Program (Alternative 1) and less than the Alternatives 2,3, and 4 due to reduced program efficiencies and reduced long-term success. Like the other alternatives, negative effects on feral swine hunting related businesses would have a reverse effect on hunting related business for other game species that are adversely affected by feral swine, as long as feral swine populations were successfully controlled in these areas.

Changes in available funding under this alternative would have similar impacts as with the Integrated FSDM Program (Alternative 2) with the exception that some national-level activities would be unavailable no matter how much funding is provided to the program. In all instances, administrative costs and operational inefficiencies are likely to result in less FSDM being conducted with a set amount of funds than under the Integrated FSDM Program (Alternative 2). The overall decrease in operational funding is likely to increase the long-term time and costs needed to achieve project objectives compared with the other action alternatives (Alternatives 2-4).

The number of feral swine removed, and the associated crop damages avoided would be greater than the Current FSDM Program (Alternative 1), but lower than the National and Baseline FSDM Programs (Alternatives 2 and 3, respectively) since efficiencies would be substantially reduced. This alternative could at least initially prevent more crop damage than National FSDM and Strategic Local Projects (Alternative 4) since that alternative would focus the most efforts on states with smaller populations of feral swine. The relative effects on crop protection are difficult to determine since would-be grant recipient objectives for projects are unknown at this time, and priorities for crop producing areas may differ in different states, with differing pressures from farmers and agricultural agencies. Since funds would not be assured for research, education, outreach, and surveillance, long term efficiencies are less likely and crop damages would be expected to continue and even expand in many areas.

## D. Short-Term Uses and Long-Term Productivity

Pursuant to NEPA (Section 101), the alternatives evaluated in this EIS "us[e] all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which humans and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans." Feral swine are a threat to the productivity and balance of the human environment. The preferred action and alternatives were created to reduce that threat by guiding the development of FSDM planning and resource allocation to meet program goals to reduce feral swine damage. Specific short-term impacts on the human environment from implementing the alternatives are discussed in detail in Chapter 4. Mitigation to reduce potential adverse short term impacts and to help ensure long term productivity was built into the alternatives as SOPs.

## E. Unavoidable Adverse Effects

The five alternatives provide a programmatic direction for how APHIS would focus FSDM assistance to the agencies, tribes, organization and others who may request assistance, and how it would support national goals for FSDM. Regardless of which alternative is selected, subsequent local or National decisions would determine how, where, and to whom assistance is provided, so long as that assistance falls within the parameters specified in this EIS. FSDM decisions under any alternative would not remove any applicable legal protections in place for the protection of the environment, and APHIS would adhere to all applicable SOPs (Section 2.C.E.). As discussed under the analysis of Environmental Consequences for each alternative (Section 4.C.), the environmental effects may differ somewhat, but none of the alternatives was found to result in unavoidable adverse effects on the human environment.

## F. Irreversible and Irretrievable Commitments of Resources

The analysis shows there is not an irreversible commitment of resources since future options for the evaluated resource would not be lost. Effects on nonrenewable resources include cultural resources and soils; however, effects were determined to be negligible based in part on the ability to identify conflicts in planning stages, the flexibility of the program to make adjustments to project locations to avoid or minimize adverse effects, and SOPs which serve to minimize adverse effects under any selected alternative. In contrast, by reducing feral swine damage to nonrenewable resources, such as historic or cultural sites, and preventing damage to rare ecosystems and species, the proposed action is expected to reduce existing irreversible and irretrievable impacts on resources. Soils and cultural resources would benefit from any of the alternatives.

Feral swine could be expected to be removed completely from some states with small or emergent populations. States that desire to keep and manage feral swine would still do so under their regulatory authorities. Therefore, there is no irretrievable commitment of resources (e.g. loss of use of feral swine) identified in this proposal. Given the adaptability and reproductive capacity of feral swine, in the improbable event that an area were to later regret eradication of feral swine, the animals could be readily and rapidly reintroduced to the system. Adverse biological effects would be minor or completely eliminated based on SOPs built into all program alternatives (e.g. effects on endangered species, other non-target animals and vegetation). Effects would benefit natural resources by removing a destructive, invasive species.

No construction is proposed and no other aspects of the alternatives involve major commitments of resources. The only irreversible and irretrievable commitments of resources would be the use of fossil fuels for normal maintenance and operations, with variation in the fuels used to operate aircraft and vehicles. The level of use of fossil fuels was evaluated under Section 4.C.6, Climate Change.

## G. Incomplete or Unavailable Information

CEQ regulations (40 CFR S. 1502.22) state that an EIS should be clear about lacking information if the EIS identifies reasonably foreseeable significant adverse effects on the human environment. Significant adverse effects have not been identified in this EIS. Throughout the analysis, the DEIS identifies areas where research, further NEPA and other compliance, and information that is currently unavailable, would help to meet program goals, enhance program delivery, improve efficiencies, or communicate site-specific environmental analyses.

1. A comprehensive analysis of the costs and benefits of FSDM.

2. Comprehensive data on the effects of feral swine hunting and associated businesses.

3. Comprehensive data on the effects of feral swine hunting on the ability to achieve agency FSDM goals.

4. A lack of regulatory oversight over feral swine carcass burial. State agency regulations on feral swine management vary widely, but only one state has addressed feral swine burial in terms of protection of water quality. Where feral swine are buried on-site as part of routine livestock disposal practices, the analysis shows that the cumulative effects of this action on water quality are not precisely known because routine livestock burial regulations are not necessarily based on scientific analysis.

5. A lack of scientific analysis of the indirect effects of on-site feral swine burial on water quality, human health and safety, and non-target effects as relates to survival of pathogens and chemical leachate from carcass decomposition.

6. Site specific impacts cannot always be anticipated, therefore, local analyses in the form of environmental assessments or other records would be completed to ensure that local programs are consistent with the adopted alternative, and SOPs from this EIS. In addition, local analyses would include any additional substantive local issues that were not addressed in this EIS.

7. Communication and outreach is essential to influencing public attitudes about the acceptability of moving feral swine for hunting opportunities. Assessing the efficacy of communication and outreach is largely unavailable.

8. Fencing is not always effective in keeping domestic swine from escaping to become feral swine. Fencing is necessary to both contain domestic swine, as well as keep feral swine from entering and posing disease problems.

## H. CUMMULATIVE EFFECTS

Cumulative effects are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR § 1508.7). The existing environment discussed in Chapter 2 identifies and defines the potentially affected environmental issues and resources raised during scoping. The existing environment represents the aggregate impacts of past actions. When proposed, present and reasonably foreseeable future actions are added to the aggregate impacts of past actions, the cumulative effects can be estimated. The cumulative effects are discussed in this section where they could be identified, commensurate with the potential for significance (CEQ 2005).

The alternatives are nationwide in scope and could extend, in theory, to any location where feral swine may occur presently or in the foreseeable future, and on lands with any ownership or management scheme. While the scope of the EIS is national (including Territories and Tribal lands), the actual individual project locations would be relatively small and widely dispersed since they are based on the location and dispersal of feral swine across the landscape. The preferred action would guide resource allocation and establish a plan of actions to achieve nationally established goals and objectives for FSDM (Section 1.H.). The individual operational control actions would be small scale, of short-duration, and would be temporary. Most actions would be beneficial, and any harm is most often negligible.

Most individual feral swine damage management operational projects typically have minimal impacts because they are widely dispersed, on a small scale individually, are of short-duration, and most impacts are temporary. Temporary effects are not considered to be significant (Mendelker 2009, 8:51). These types of projects and impacts are not expected to contribute significantly to cumulative effects and do not require detailed analysis in an EIS (Mendelker 2009; 8:51, 10-147). Furthermore, the potential for adverse effects on the environment has already been mitigated through adherence to applicable laws, regulations, program policies, SOPs, and through cooperation with resource management experts. Numerous laws apply to the actions and that have been evaluated. These laws have been enacted to protect specific environmental resources (Section 3.E). Federal laws include ESA, MBTA, BGEPA, NHPA, and FIFRA. APHIS-WS program policies and directives and SOPs further minimize the potential for adverse effects. In addition, because APHIS-WS does not manage affected resources or feral swine, it conforms to applicable State, Territorial, and tribal government laws for environmental protection. Finally, when APHIS cooperates with other federal agencies, it follows cooperating and partner agency policies and rules for environmental protection as defined in MOUs, work plans, and other agreements.

### 1. Threatened and Endangered Species

The analysis of effects in Chapter 4 on T&E species has shown that operational APHIS-WS programs, including FSDM programs, have not resulted in jeopardy and most often result in findings of "no effect" or "not likely to adversely affect" for species that are federally protected by the ESA. FSDM actions could occur any place that feral swine are found, as long as assistance is requested and the actions are allowed by Federal, State, Territorial, Tribal, and local laws. In some cases, this may be where feral swine are causing direct damage to listed species or their habitats. Because potentially affected listed species are already protected by ESA based on their vulnerability to extinction from different sources, they are particularly sensitive to adverse cumulative effects. Other Federal agencies must consult with FWS or NOAA under Section 7 of the ESA when their actions may affect listed species. The ESA contains other provisions for public agencies and private and other entities to conserve listed species and not adversely modify or destroy their critical habitats. The ESA is a substantive statute implemented and enforced by FWS and NOAA. It is intended to ensure that T&E species are conserved and extinctions do not occur (16 U.S.C. §1531(b)). FWS and NOAA work with APHIS as they work with others to evaluate and mitigate significant adverse individual and cumulative effects on listed species. APHIS-WS and Federal partner agencies are bound to protective measures in the ESA which require them to consult with FWS/NOAA to ensure that any actions resulting from decisions associated with this EIS (i.e. any actions "authorized, funded, or carried out by such agency. . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. . . . " (16 U.S.C. §1536(a)(2)). The cumulative effects of effective FSDM to protect plants, animals, soils, and water, may provide benefit to species that are or could be directly or indirectly adversely affected by feral swine activity because removing feral swine removes the potential for future or continued damages. Feral swine removal is integral to native ecosystem restoration and effective removal or elimination would facilitate such efforts. For these reasons, significant adverse cumulative effects from FSDM are not expected.

**2. Non-target Animals**

The analysis of effects on non-target animals in Chapter 4 demonstrated that APHIS-WS FSDM activities would not have a negative effect on non-target species' populations, and beneficial effects from the removal of feral swine to protect native habitat is expected to outweigh any negative effects of non-target take. APHIS-WS' historic non-target take is generally a very small percentage of both the non-target species populations and the overall APHIS-WS target species take. Non-target species that are most often associated with FSDM activities are generally common species, often game animals or other species monitored by State natural resources agencies, such as coyotes or deer. Nationwide, populations of such species are generally stable, and associated with other forms of regulated mortality, such as hunting and trapping, without adverse effects on the populations. Effects on non-target species are assessed at the State, Territorial, Tribal, or regional level, where local resource management agencies can help to provide data on population size, trends, and other sources of known take. Effects on non-target species populations are typically negligible and are temporary. APHIS environmental assessments on FSDM and on wildlife damage management continue to demonstrate repeatedly that no significant adverse effects have occurred at the local level (i.e., State, regional, or Territorial levels), the level at which non-target species are managed. Significant cumulative effects at the programmatic level are not expected since non-target take from FSDM methods is low, take would not be concentrated in any one area, non-target take is typically of species that are widespread and abundant, and no population effects are seen. APHIS-WS works with State, Territorial, or Tribal natural resource managers, communicating the risks of FSDM and evaluating effects on non-target species to further ensure that cumulative take of any species would not have negative effects on the population. For these reasons, there would not be adverse cumulative effects on non-target species populations.

Risks Associated with Lead Ammunition

Chapter 4 contains an evaluation of the risks of lead from APHIS-WS FSDM shooting activities on the environment and on public safety and health. Lead has wide-ranging adverse effects on most biological systems in humans and non-target animals. Exposure and risk to non-target animals would be greatest for wild and domestic animals that consume feral swine carcasses containing lead ammunition. There is also the potential for lead exposure to non-target mammals and birds from consumption of lead bullet fragments in the soil. Exposure and risk to the public and to aquatic organisms such as fish and aquatic invertebrates is expected to be negligible.

The cumulative sources of lead include other APHIS programs beyond FSDM. Non-APHIS sources including firearms, hunting, and shooting activities as well as airborne emissions from metals industries (such as lead smelters and iron and steel production), manufacturing industries, and waste incineration are large sources of lead. USEPA estimates that approximately 72,600 metric tons of lead shot and bullets are deposited in the U.S. environment each year at outdoor shooting ranges (USEPA 2001). The reported lead accumulation rates on individual shooting ranges are between 1.4 to greater than 15 metric tons per year (The Wildlife Society 2008). Recent data from USGS (2011) shows that U.S. use of lead from ammunition, shot and bullets was 69,200 metric tons. An approximated 3,977 metric tons of lead fishing sinkers are sold in the United States annually (The Wildlife Society 2008). In comparison, average lead use in all APHIS-WS programs is approximately 1.174 metric tons per year. The average yearly total amount of lead used in all states by APHIS-WS (FY08-FY12) was small (0.0017%) compared to the U.S. use of lead from ammunition, shot, and bullets based on data from 2011 (USGS 2011).

APHIS-WS adheres to all applicable laws governing the use of lead ammunition, as well as to all lead use restrictions posed by landowners/manager. Because APHIS and others are concerned about the effects of lead in the environment, APHIS is committing to utilize lead-free ammunition options in FSDM above and beyond those required at national, state, local and landowner levels, whenever supplies that meet WS standards for safety, performance, and humaneness are developed and become reliably available in adequate quantities for program use. In this way, APHIS would be taking steps to protect non-target animals and the environment well beyond levels set by agencies and regulators with jurisdiction over wildlife management and the use of lead ammunition. Given that the majority of lead ammunition is used by non-WS entities, the decisions made by States, Federal regulatory agencies, and land management agencies regarding use of lead ammunition will be the greatest factor affecting the cumulative contribution of lead in the environment.

Because APHIS-WS' contribution of lead to the environment is minor, because the FSDM program would incorporate non-lead ammunition to the maximum extent practicable, and because APHIS-WS is working to reduce the use of lead ammunition program wide, the cumulative effects from APHIS-WS FSDM program are anticipated to be incrementally negligible.

### 3. Water, Soils, and Vegetation

Most FSDM actions assessed in Chapter 4 would not have the potential for significant adverse effects on water, soils, and vegetation. Many factors can contribute to adverse effects on water, soils, and vegetation including development, agriculture, and climate change. Feral swine are one of the factors that contribute to adverse effects as discussed in Chapter 3. Without FSDM, negative effects are expected to continue to grow over time and expand to new areas. Of the FSDM actions, carcass burial could potentially contribute to adverse cumulative effects if larger burial pits were used or if existing pits or trenches for routine livestock carcass disposal were used and appropriate measures were not taken to protect soils and water quality. APHIS does not anticipate that it would use burial in most states or territories. It is unknown if cooperating agencies requesting FSDM may choose this disposal option over other options in the foreseeable future. Burial of feral swine carcasses, if used as a disposal method, would be on a small scale, would not typically involve more than one sounder, and therefore would involve a relatively small amount of excavation. Thus, the individual projects would be few and far between, and these projects would be small in size.

Nationally, these effects would not contribute to significant adverse effects on water quality, soils, or vegetation. Assessing cumulative effects on soils and water quality would require local site specific analysis because site locations cannot be determined until local projects are proposed. However, because siting is flexible and can often avoid sensitive areas (such as shallow water tables, near other water sources, or occurring in fragile soils), the potential to cause more than a short term disturbance is not expected. SOPs for soil conservation include preservation of topsoil, and erosion control and revegetation. Avoiding cumulative effects on water quality can be done by assessing sites and consulting with land and resource management authorities. Therefore, national and local adverse significant cumulative effects are not expected to occur from carcass burial. Overall, the effect of FSDM on soils, water and vegetation would be to provide short and long term benefit, most notably in areas where feral swine can be eliminated or populations can be substantially reduced. For these reasons, there are no adverse cumulative effects on soils, water, or vegetation expected nationally or locally from FSDM.

**4. Odor/Air Quality**

Odor associated with feral swine carcass management would not be likely to contribute significantly to cumulative effects on air quality for several reasons. Feral swine carcass management would be dispersed and each disposal action would represent at most a small scale project with short term, temporary odor effects. Odor from feral swine is not considered a health risk. APHIS would only leave feral swine carcasses on site where land uses, agreements with landowners and land managers, and local regulations indicate and allow. Carcass odor is also a temporary issue and would not contribute to significant cumulative air quality or odor issues. The cumulative effects of disposal at approved landfills and licensed rendering or incineration facilities would not contribute substantively to existing and future odor problems because of the minor and temporary contribution of FSDM generated carcasses, and because these regulated facilities have odor mitigation measures in place. Composting may be used by landowners for feral swine and routine livestock disposal, but proper composing would not generate offensive odors. Finally APHIS-WS would not use open burning unless it was required by regulations and it could be conducted safely. Anaerobic digesters are a potential disposal option that could generate odors. The possibility of their use is low in the foreseeable future. Alkaline hydrolysis may produce only minor odors however this option is unlikely to be used. For these reasons, there are no adverse cumulative effects expected nationally or locally to Odor/Air Quality from FSDM.

## 5. Recreation

Feral Swine Hunting

As discussed in Chapter 3, the past actions of feral swine hunters, along with state and local regulations that allow feral swine hunting have exacerbated feral swine populations and increased hunting opportunities in many areas. The cumulative effects on feral swine hunting would primarily be determined by State, Tribal, or Territorial management agencies as they implement, add and/or enforce feral swine hunting regulations. APHIS would contribute to the cumulative effects on feral swine hunting opportunities through a number of different actions including direct FSDM assistance, by supporting cost share opportunities that increase operations, through outreach and education efforts, and through research that may result in more effective operational control methods in the future. For those states and territories that choose to maintain regulations for managing feral swine as a game animal, the cumulative effects on feral swine hunters would not be great because feral swine would continue to be readily available for hunters in those areas where the appropriate regulatory areas desired. Feral swine hunters in other states in which feral swine populations are well established would not experience cumulative effects because feral swine populations would not be eliminated. Shooting feral swine is sometimes incidental to hunting for other species. As discussed under cumulative effects on “Hunting Other Game Animals” (directly following this subsection), it is likely that success in FSDM would increase hunting opportunities for some other game animals.

Thus, adverse cumulative effects on feral swine hunters may be offset for some hunters. As discussed in Chapter 4, Section 5.b., feral swine become more difficult to hunt as damage control pressures increase. Thus there are several considerations regarding the cumulative effects on feral swine hunters. Because states, territories and tribes establish the regulations and management objectives for hunting and feral swine populations, APHIS would work under those guidelines in partnership to achieve these results. In those States, Tribes, and Territories choose to eliminate feral swine, feral swine hunting opportunities would be reduced or eliminated. However, these effects are considered to be minor because feral swine hunting traditions in these areas may not exist, are not well established, or are not widespread. Significant adverse cumulative effects nationwide are not expected because regulations would guide FSDM, however, some localized hunter groups could be adversely affected by both the actions of APHIS, states and land managers with goals of eliminating feral swine.

Hunting other Game Animals

Like feral swine hunting opportunities, the cumulative effects on hunting opportunities for other game animals is likewise dependent upon regulatory actions and enforcement by state, tribal and territorial agencies that oversee feral swine management. Many factors affect populations of other game animals including habitat changes, disease, predation and management actions. As discussed in Chapter 4, Section 5.b., removing feral swine would be expected to contribute indirectly as potential benefit to some populations of game species. Adverse effects from feral swine through habitat destruction or predation would be reduced in some areas, and eliminated in others. While some individual game animals may be adversely affected by FSDM operational methods, no population level impacts are expected, and the net effect on any species adversely affected by feral swine would be positive. Most game management agencies and many hunters favor FSDM as a benefit to sound game management practices. FSDM would not contribute to adverse cumulative effects on hunters of other game animals.

Aesthetic Values

Successful FSDM program implementation would assist land and recreation management agencies and others involved in protecting the aesthetic values of sites from feral swine damage, especially where feral swine populations are eliminated or substantially reduced. Some that value feral swine for intrinsic purposes would be adversely affected, especially where feral swine were eliminated by APHIS and partner agencies. In balance, the long term aesthetic quality of the environment would be enhanced by FSDM and would not contribute to adverse cumulative effects on aesthetic values.

Disturbance to Recreationists

As discussed in Chapter 4, Section C.4.b., FSDM may have infrequent, short term, temporary impacts on recreationists. Most people would not be aware of FSDM activities based on the low frequency and geographic extent of operations, and based on coordination with management agencies to minimize exposure to recreationists. FSDM would not contribute to negative cumulative effects on disturbances in recreation.

### 6. Climate Change

FSDM does not involve a national policy decision on any activities that would generate substantial GHG impacts. The contribution of the combined FSDM and APHIS wildlife damage management programs to the APHIS-WS cumulative level of GHG (in $CO_2$ equivalents) is below the reference point of 25,000 MT/year suggested by CEQ for detailed analysis in an EIS. FSDM involves the use of vehicles for routine operations to transport personnel and equipment to work sites. Vehicle use would not increase substantially over current APHIS levels, in part because personnel and equipment would be transferred within the agency from other operations. For example, existing vehicles are being redirected to the FSDM program, and additional purchases and use would be minimal. Conversely, FSDM may provide an important benefit to ecosystems that have been, are and may be stressed by climate change. As changes in temperature and precipitation contribute cumulative stressors on ecosystems, FSDM would provide some relief to those species and systems that are adversely affected by feral swine. Without a coordinated national FSDM approach, feral swine populations would be expected to continue to expand their range into more northern latitudes and into higher elevations, and to continue to increase in number overall. FSDM is expected to reverse the trend of expansion and eliminate populations in many areas. This would indirectly benefit resources that are expected to experience significant cumulative stressors from climate change impacts. The FSDM program would benefit resources that may experience adverse effects from climate change, but would not contribute meaningfully to significant adverse cumulative effects on climate change.

### 7. Human Health and Safety

The analysis in Chapter 4, Section C.7.b. indicates that the effects of FSDM actions on public health and safety are expected to be negligible for many reasons including safety policies, training and certification, coordination and agreements with landowners and land managers, adherence to regulations and other program SOPs, and timing and location of the use of methods to minimize public exposure. Safety risks are greatest for APHIS-WS personnel implementing FSDM methods, however safety protocol minimize adverse events. For these reasons, FSDM would not contribute to cumulative adverse effects on human health or safety. Short and long term benefits to the public may be achieved by reducing the potential for zoonotic disease transmission, swine-vehicle accidents, and aggressive encounters with feral swine.

### 8. Sociocultural Resources

Cultural Resources.
With the exception of carcass burial and digging holes to install permanent fence posts, most program actions, as implemented according to SOPs, are not the type that would typically adversely affect historic properties[29]. Carcass burial and post hole digging would not be widely used by the FSDM program but where used, coordination with land management agencies and landowners, consultations with SHPO, THPO or other tribal representatives as needed, and making local siting decisions to avoid adverse effects are SOPs that are in place would mitigate any potential for contributing adverse cumulative effects on properties that are either included in, or eligible for listing on the National Register of Historic Places. As discussed in Chapter 3, feral swine can inflict damage to historic and other cultural resources. When APHIS-WS responds to requests by resource managers to protect historic or other cultural resource sites from feral swine damage, APHIS-WS would coordinate as appropriate with SHPOs, Tribes, and requesting agency experts to ensure that NHPA requirements are met. In most cases, no adverse effects would be anticipated because actions in vulnerable sites could be avoided. While historic properties may be subject to adverse cumulative impacts over time from natural (e.g. weather) and human induced (e.g. development) influences, the FSDM program would not add to these adverse effects. The net effect is likely to be that historic properties may benefit by removals of feral swine, especially in areas where populations can be eliminated or substantially reduced. For these reasons, the FSDM program would not

[29] The term "historic property" is defined in the NHPA as: "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register"; such term includes artifacts, records, and remains which are related to such district, site, building, structure, or object. 16 U.S.C. Section 470(w)(5).

contribute to adverse cumulative impacts on cultural resources, and may provide benefit by removing feral swine that may damage historic sites or objects or other culturally important resources.

Tribes, Traditional Cultures and Ceremonial Values

In states or territories where feral swine have traditional, ceremonial or other cultural value, feral swine populations would be either eliminated or reduced. It is possible that conflicts between tribes and states could arise where tribes and states have different management objectives for feral swine. Expanded removals in Hawaii and other areas where feral swine have important traditional uses would not affect public hunting because of existing SOPs to preserve hunting opportunities on public lands. Efforts to protect native and endangered species and their habitats would likely increase which may benefit other traditional and cultural values.

Early outreach, coordination and consultation with Tribes during the development of this EIS, and APHIS-WS state and local level NEPA documents helps ensure that tribal management objectives and issues are included in planning, and that adverse effects are avoided or mitigated. FSDM is not expected to adversely affect Tribes, Traditional Cultures and Ceremonial Values and would not contribute to adverse cumulative effects.

Humaneness and ethical perspectives

Feral swine are by definition free roaming animals and thus are not subject to cumulative adverse humane treatment in the way that domestic animals in production, wild animals in captivity or animals that are used for scientific purposes are handled and treated by humans. In this sense, it is not likely that humans are having significant cumulative effects on the humane treatment of individual feral swine. There may be a very limited number of individual feral swine that could be captured and released (e.g. a Judas pig), and then captured and killed again under the FSDM program. Or an individual feral swine could be wounded in a private hunting or control incident and then later captured and killed by the FSDM program. Most often, feral swine would not be subject to cumulative effects from humans (other than the benefits of unintentional supplemental feeding in the form of crops or livestock, or access to human created water resources). Most disease sampling is taken from feral swine that are already killed for damage management, thus this activity typically does not involve added capture or killing. The methods used to capture and kill feral swine are not considered to be inhumane and are considered to be ethically necessary. In the foreseeable future, toxicants and reproductive inhibitors may be made available as a result of research, product development, and registration, however at this time, no proposals have been made. These tools, if made available, would likely influence the perceptions of humaneness and ethics. Some people would be expected to oppose the use of toxicants, while others favor a more efficient control method. Many people are expected to favor reproductive inhibitors as a humane and ethical way manage feral swine damage. Agency partners and others who participate in FSDM are likely to see a FSDM that could effectively manage invasive feral swine as an ethical and necessary. Based on the ethics models assessed in Chapter 4, Section 8.b., the preferred alternative would be both ethical and humane, and would not result in adverse cumulative effects.

## 9. Economic Impacts

Cost share and efficiency

The preferred FSDM program is likely to contribute benefits to those who are or who may be experiencing economic losses associated with feral swine damages and disease threats. Until Congress directed funds for a national FSDM program, the ability of APHIS to provide operational services to land and resource managers was largely dependent upon cooperator funding. As long as dedicated Federal assistance remains a priority to Congress, some level of federal funding is expected be available to cost share FSDM services. Funding is also expected to be available to help create efficiencies to reduce the costs of FSDM over time. One efficiency that is expected to be associated with funding in the foreseeable future would be the development of more cost effective methods to control feral swine populations. The toxicant sodium nitrite, and a feed-based formulation of the reproductive inhibitor GonaCon are not currently proposed for use, but many experts expect there is a good chance that these products would be developed, registered, and available for use in the future and they would contribute to increased economic efficiencies.

Damage prevented

Crop damage prevented used the best available information for estimating economic effects on crop producers. This was based on estimated damages that can be prevented. As presented in Chapter 4, Section 9, the FSDM program in the recent past was estimated to have prevented approximately $7.1 million in crop damages. Estimates for the foreseeable future associated with the preferred FSDM program were estimated to be between $16.4 million to $23.5 million in crop damage prevented per year. Benefits would vary depending on a number of factors including the phase of the programs and where they are located.  Crop producers are expected to experience numerous challenges to production including those directly and indirectly related to climate change. Examples are expected to include temperature and precipitation changes, as well as indirect effects from new or expanded ranges of pest species.

One distinct advantage of the Integrated FSDM Program would be to provide some degree of economic relief via damages prevented by assisting low income landowners and communities that experience feral swine damages. Assistance to these agricultural producers would likely be increased over past and present levels, as states, tribes and territories participate with APHIS in FSDM. The small and lower income producer has a lower economic margin for absorbing losses from feral swine, therefore, relative benefits would probably be higher than to larger operations. To the extent feral swine damages may be diminished or prevented in some areas in the foreseeable future, the program would provide benefits to crop producers of all income levels, and would not contribute to cumulative adverse effects.

There are individual, local and state/territorial/tribal economies that seek economic gains from feral swine in their states. These include state agencies that manage feral swine as a game animal and thus receive hunting related revenues, those that own or manage hunting preserves, those with other hunting related businesses, and private pest control operators that control feral swine. Feral swine sport hunting businesses, private pest control operators, and people who use feral swine for food could be negatively affected in the long term except where feral swine populations are well established and where feral swine are not managed as a game animal. On the other hand, businesses that supply FSDM equipment and supplies would initially benefit from increased sales but long term program success would reduce purchases over time. For the same reasons that are discussed under Chapter 4, Section H. 5, the effects of the Integrated FSDM Program on local and individual economies that benefit from feral swine would be dependent on state, tribal and territorial regulations and management objectives for feral swine.

The education and outreach component described under the preferred FSDM program is intended in part to indirectly affect human behaviors over time so that individuals, agencies and lawmakers in some places trend towards increasing restrictions on activities that exacerbate feral swine population growth and movements. This may include increased compliance or enforcement with existing regulations restricting the movement (spread) of feral swine, reduced feral swine hunting, reclassifying feral swine as a pest species in need of focused management, preparing feral swine eradication plans, or creating or changing regulations to limit or disallow hunting of feral swine.

Federal and state expenditures on feral swine damage management would be expected to decrease over time as feral swine populations are eliminated or substantially reduced. Formal cost benefit analyses of FSDM have not yet been developed, however the preferred alternative includes economic research that would endeavor to develop these kinds of data. The information would then be available to communicate with policy makers and lawmakers to help make economic decisions on future FSDM.

**Table 4-7.** Summary of Environmental Consequences.

| **Effect on Threatened and Endangered Species and Critical Habitats** | |
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| Alternative 1. No Action Alternative (Current FSDM Program) | The primary risks to ESA T&E animals are disturbance, the use of traps, snares, lead ammunition, and feral swine carcasses attracting scavengers to areas with vulnerable species. The risk to plant species is primarily from minor ground disturbance and in limited situations where burial may be used as a carcass disposal option. ESA Section 7 consultations between APHIS-WS state programs and FWS have shown that FSDM activities, with the inclusion of SOPs and other measures at the regional, state, or local level, are not likely to adversely affect most listed species, and would not jeopardize the continued existence of others. The Current FSDM program does not destroy or adversely modify critical habitat. In some areas FSDM programs are being conducted for the protection of T&E species. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | Based on the flexibility of how and where FSDM methods are used, and based on SOPs including coordination with land management agencies and landowners, adverse effects on T&E species and critical habitats are not expected to increase substantially over current program levels. Expanded and new programs may require supplemented or new Section 7 consultations but conclusions similar to the Current FSDM Program are expected. APHIS would not proceed with an action that the FWS has determined could jeopardize the continued existence of any species. This alternative may provide the greatest level of benefit to listed species and critical habitats based on efficacy projections. |
| Alternative 3. Baseline FSDM Program | Effects are expected to be similar to the Integrated FSDM Program. Although methods are the same for all alternatives, the total operational FSDM conducted is expected to be greatest for this Alternative. Consequently, potential risks of this alternative will be similar in nature but slightly greater in scope than for the Integrated FSDM Program. Potential benefits to listed species and critical habitats would be greater than the Current FSDM Program but less than the Integrated FSDM Program based on the efficacy analysis. |
| Alternative 4. National FSDM without Baseline Funding | Effects would be similar in nature to the Current FSDM Program where no baseline funding was applied. Adverse effects would be more localized based on national and local priority projects than the Integrated and Baseline FSDM Programs, and potential benefits would likely be achieved more quickly under this alternative than under the remaining alternatives. However, in the interim, states which are low priorities for FSDM will receive little additional support for projects to protect endangered species and critical. |
| Alternative 5 - Federal FSDM Grant Program | APHIS-WS would not directly affect ESA listed species or critical habitats, but grants would be issued to support programs similar to those under the FSDM Program. New ESA consultations would be necessary to implement grant programs. Grant recipients would be expected to implement measures to minimize or avoid adverse effects on listed species. This alternative has the lowest potential to benefit listed species and critical habitats due to inefficiencies associated with operational program delivery, and from a loss of NWRC involvement in new product development. |

| Effect on Non-target Animals | |
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| Alternative 1. No Action Alternative (Current FSDM Program) | Adverse impacts on non-target animals from the use of non-lethal methods are low. Some agencies are using fencing extensively which can affect non-target animals. Neck or body snares may directly harm or kill non-target animals. Indirect harmful effects on non-target animals may arise from consuming lead bullet fragments or shot either in a carcass or in the environment, disturbance from aircraft, euthanasia chemicals and risk of pseudorabies exposure from feral swine carcasses.<br>Compliance with regulations, consultations and agreements with resource management experts, program policies, SOPs and the use of the APHIS-WS Decision Model (Slate et al. 1992) minimize risks. While there has been take of individual animals, there have been no adverse direct or cumulative effects on any populations of non-target species.<br>There has been no non-purposeful take of eagles by the FSDM program but there is some risk from the use of traps and snares. APHIS consults with the FWS when activities may pose a risk to eagles.<br>Some populations of non-target species including ground nesting birds, some reptiles, amphibians and small mammals may benefit from locally conducted FSDM by reducing feral swine predation. Other indirect benefits include reduction of feral swine created mosquito habitat and the spread of mosquito-borne avian diseases, reduced competition for available resources and reduced habitat damages. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | Non-target impacts would be similar in nature to the current program because this alternative uses the same methods, program policies, SOPs and compliance with regulations to minimizes risk.  However effects would be expected to be greater in scope because of the increased level of FSDM and anticipated increases in the use of aerial shooting and corral traps which present a low risk to non-target animals. No adverse effects on non-target species populations are expected.<br><br>GonaCon™ injectable, if registered for use in feral swine and adopted into the program, is not expected to have widespread use and would not adversely affect non-target animals.<br><br>Program effects would not contribute substantially to current conditions. Recreational lead ammunition use, where allowed by state law, is the primary use.  State and Federal regulations have the greatest effect on lead use. APHIS-WS is working to reduce its use of lead ammunition considering the constraints of availability, safety, efficacy and cost.<br><br>The overall beneficial effects on non-target animals is expected to exceed any harmful effects. Benefits to species negatively impacted by FSDM are likely to be balanced based on damage control and feral swine elimination. |

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| Alternative 3. Baseline FSDM Program | The potential for negative effects on non-target animals may increase because this alternative would likely have the greatest level of operational FSDM, however general impacts would be similar to the FSDM Program.<br><br>Feral swine populations in some States that receive less or no baseline funding would be expected to increase, therefore, negative effects on non-target animals associated with feral swine damage would be expected to continue. |
| Alternative 4. National FSDM without Baseline Funding | Effects would be similar to the Current FSDM Program alternative, and lower than the Integrated FSDM Program in locations not identified as priorities for national or strategic local projects. Areas identified as priorities for National and strategic local projects may be temporarily subject to increased impacts because FSDM resources would be concentrated for these areas. Effects would be minimized based on program practices including SOPs in the same manner as the first three alternatives. No adverse effects on populations of non-target species are expected.<br><br>Because this alternative may make it possible to achieve national feral swine population objectives more quickly than under other alternatives, overall benefits to non-target species from managing feral swine damage may also be expected more quickly, especially in those states where feral swine populations can be eliminated or substantially reduced. |
| Alternative 5 - Federal FSDM Grant Program | Risks to non-target animals is expected to be similar to or slightly less than the Integrated FSDM Program assuming grant recipients adhered to program SOPs. Risks and benefits associated with development of new products would be slowed. Benefits to non-target animals would likely be lower than the other action alternatives because the cost of program administration would reduce operational funds.<br><br>Efficacy in protecting non-target species and habitats from feral swine may be more variable depending on the skills and abilities of grant recipients. |
| **Effects on Soils, Vegetation, and Water** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | Most FSDM methods pose little risk to soils, vegetation and water quality when conducted according to program policies. Post hole digging for permanent fencing would permanently affect soils at the post sites, however APHIS-WS would rarely build permanent fencing. Carcass burial causes temporary localized adverse effects on soils and vegetation through disturbance. Carcass burial may also adversely affect soils and ground and surface water quality with contamination of nitrogen, chloride, and coliform bacteria. Burial is currently used infrequently in only a few States. Most States do not have regulations or guidelines for the safe burial of feral swine carcasses. APHIS-WS minimizes adverse effects of carcass decomposition and water contamination by avoiding excavation of burial |

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| | sites above shallow groundwater or near other water sources. Measures to conserve topsoil and protect vegetation and water quality would be implemented. Soil trampling and mixing from feral swine within in corral traps would occur, but corral traps are typically located in areas that have already been disturbed by feral swine activity.<br><br>Bait selection and coordination with land management agencies would minimize the potential for introducing invasive weed species into work sites.<br><br>Contamination of soils and aquatic environments with lead shot and bullets used for FSDM would be minimal. Negative effects on soils, vegetation and water quality are minor and are outweighed by localized program benefits. Direct and indirect damages from feral swine on soils, vegetation and water quality would be expected to continue to increase along with the feral swine population. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | Risks would be similar in nature to Alternative 1 because the same methods would be used. However, impacts would be greater in scope because of the increase in FSDM. Carcass management would become a greater issue as removals increase. If burial is used more frequently, associated effects on soils and water quality would become a more frequent issue. Burial would still be expected to be used infrequently and most burial would involve few carcasses at any one location. Effects may increase if landowners or land management agencies with larger properties use larger burial sites for greater numbers of carcasses. Cumulative effects are not expected to be problematic if landowners use existing livestock burial or composting systems and are following local guidelines for routine livestock disposal.<br><br>Lacking regulatory controls for feral swine burial, burial site selection, size, depth and cover would be planned with local resource authorities to reduce the risk of water and soil contamination. Burial site remediation would include soil conservation measures to protect soils, vegetation and water quality.<br><br>APHIS-WS would not establish new compost sties. Landowners or land managers that use on-site composting in accordance with State and local guidance would minimize risks of water contamination.<br><br>Lead ammunition use would increase but would not be expected to impair water quality or raise baseline soil concentrations. Efforts to identify and acquire non lead ammunition would be coordinated at the national level. This alternative would be likely to provide widespread and long term benefits to soils, vegetation and water quality by effectively removing feral swine. |
| Alternative 3. | Effects would be similar to the Integrated FSDM Program but this alternative may have the highest the number of |

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| Baseline FSDM Program | carcasses for disposal and associated environmental risks because it allocates the most funding to operational FSDM. SOPs identical to those in the two alternatives with National and strategic local projects would minimize risks. Benefits to soils, vegetation and water quality from removing feral swine may be more immediate and widespread than the Integrated FSDM Program with all emphasis in field operations. In the longer term, benefits would be reduced in correlation with anticipated lower long term program efficacy. |
| Alternative 4. National FSDM without Baseline Funding | Effects on soils, vegetation and water quality would be similar to the Current FSDM Program in areas where national and strategic local projects are not planned. Risks in national and strategic local priority areas would be similar to The Integrated FSDM Program. Damages to soils, vegetation and water resources associated with feral swine activity may worsen in the short term where areas are not targeted as priorities but may be addressed in the long term. |
| Alternative 5 - Federal FSDM Grant Program | APHIS would have no direct effect on soils, vegetation and water quality. Grant recipients would be expected to implement SOPs to minimize adverse effects. Risks would be related to the degree that grant recipients followed protective protocols. Fewer benefits to soils, vegetation and water quality from FSDM are expected compared with the other action alternatives because administrative overhead would reduce available operational grant funding. |
| **Odor/Air Quality Effects** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | Odor impacts are associated with carcass management. Odor from feral swine is not considered a health risk. Leaving feral swine carcasses on site is the most common form of carcass disposal. Carcasses are typically dispersed and not concentrated. Carcasses would be removed from locations where human habitation or use would create a nuisance odor situation, or where landowners, land managers, or regulations indicate. Carcass disposal at approved landfills would not contribute substantively to existing odor issues because of the relative scale of the APHIS-WS contribution and because landfills already have odor mitigation measures in place. Composting would not be directly implemented by APHIS but may be used by landowners for feral swine and routine livestock disposal. Proper composing would not generate offensive odors. Rendering and other off-site carcass disposal methods would only be done at regulated facilities where odors are controlled. APHIS-WS would not use open burning unless it was required by regulations and it could be conducted safely.<br><br>APHIS Directive 2.515 allows for carcasses to be incinerated in approved facilities that comply with Federal, State, and local regulations for the management of odor and air quality. Incineration is not expected to be used as a preferred disposal option, therefore, odor and air quality are not expected to be adversely affected. Anaerobic digesters are a potential disposal option that could generate odors. The possibility of their use is low in the foreseeable future. Alkaline hydrolysis may produce only minor odors however this option is unlikely to be used. The current FSDM program has a negligible effect on air quality. |

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| Alternative 2. Integrated FSDM Program – Preferred Alternative | The Integrated FSDM Program would increase the need for carcass management. Methods and effects would be similar in nature to the current program but greater in scope. Coordination with land owners and land managers to avoid odor nuisance problems, compliance with regulatory and policy guidelines, and the dispersed nature of feral swine would ensure that this alternative does not add appreciatively to odor issues. Odor and air quality impacts would be negligible. |
| Alternative 3. Baseline FSDM Program | This alternative would likely produce the largest number of feral swine carcasses because it would allocate the most funding to operational FSDM. For the reasons discussed under the Integrated FSDM Program, odor effects and impacts on air quality would be negligible. |
| Alternative 4. National FSDM without Baseline Funding | Disposal needs and potential odor and air quality effects would be limited to national priority and strategic local project areas but for the reasons discussed under the Integrated FSDM Program would be negligible. |
| Alternative 5 - Federal FSDM Grant Program | Odor effects and impacts on air quality could range from locally problematic to negligible depending upon the entity implementing FSDM. Grant recipients would be expected to comply with APHIS-WS SOPs and other established measures for odor management and protection of air quality, so impacts should be similar to The Integrated FSDM Program. |
| **Effects on Recreation** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | Swine Hunting<br>The current program has limited effects on public hunting opportunities depending upon State management objectives and other factors including funding. Where feral swine are managed as a game animal, impacts are localized and coordinated with appropriate regulatory agencies to preserve hunting opportunities. State, territory and tribal regulations, enforcement, and management objectives for feral swine are the single greatest influence over feral swine hunting opportunities.<br>Hunters in states, territories and tribal lands that have well established feral swine populations and allow hunting but do not manage feral swine as a game animal would not likely be adversely affected because damage management is focused on properties requesting assistance and effects are localized. States with small or newly established feral swine populations could affect some hunters if hunting was legal, but swine hunting traditions are less likely to be well established in these areas. Feral swine populations and hunting opportunities have continued to grow under the current program.<br><br>Hunting other Game Animals |

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| | The current program may have some localized, limited or temporary benefits to game species that are negatively affected by feral swine. However, feral swine populations and their adverse impacts on native game species hunting opportunities would continue to increase under this alternative.<br><br><u>Aesthetic Values</u><br>The current FSDM program may temporarily and locally alleviate continued negative aesthetic effects from feral swine damages. Conversely, there are some people who may view feral swine as having a positive aesthetic value and prefer they remain in the ecosystem.<br><br><u>Disturbance to Recreationists</u><br>Disturbance to recreationists is minor, short term, temporary and infrequent. Some areas could be closed to recreation temporarily for FSDM. Aircraft used for shooting and surveillance may disturb some recreationists due to noise and sight of aircraft but for a short duration. High use recreational areas can be avoided or scheduled to minimize potential disruption. Some recreationists may see warning signs for traps and snares and be concerned about safety of pets. Public land use conflicts are minimized by coordinating projects with land and resource management experts. Work in Special Management Areas such as parks and wilderness areas and other public lands, is carefully planned and coordinated with land management agencies according to agreements, work plans, guiding legislation and land management policies to minimize disturbance. FSDM has no effect on designated wilderness suitability characteristics. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | <u>Swine Hunting</u><br>Where hunting is allowed but eradication is a State, Tribal or Territory management goal, hunting opportunities are likely to be reduced directly through reductions in swine densities and indirectly as animals becoming wary of control/hunting actions. Hunting opportunities would ultimately be eliminated if eradication is achieved. In areas where feral swine as a game mammal, hunting opportunities are not likely to be adversely affected for reasons discussed under the current FSDM program.<br>State, territory and tribal regulations, enforcement, and management objectives for feral swine would remain the single greatest influence over feral swine hunting opportunities. APHIS would have increased ability to provide technical assistance to states, tribes and territories that are developing regulations on feral swine which may impact long term opportunities for feral swine hunting.<br><br><u>Hunting other Game Animals</u><br>This alternative would benefit other game species by reducing or eliminating feral swine populations that adversely |

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| | affect the species or their habitats. This may provide benefit to States and others with meeting game management objectives and indirectly benefit hunters. Negative effects on individual game animals from FSDM methods would be negligible and would not affect populations.<br><br>Aesthetic Values<br>Successful program implementation would assist agencies and others involved in protecting the aesthetic values of sites from feral swine damage, especially where feral swine populations are eliminated or substantially reduced. Some that value feral swine for intrinsic purposes would be adversely affected, especially where feral swine were eliminated. In balance, long term aesthetic quality of the environment would be enhanced.<br><br>Disturbance to Recreationists<br>Aerial operations are likely to expand over current levels but would still be temporary, of short duration, and low frequency. Coordination with management agencies minimizes exposure to recreationists would continue. Individuals would be more likely to encounter temporary warning signs about FSDM. Corral and cage traps would only have minimal risk of disturbing the public because they would be set in locations not visible to recreational facilities to the extent practicable. Temporary and short term closures of recreation areas may be more common in some cases. Planning and coordination with land managers would ensure that disturbance and inconveniences from closures are minimized. |
| Alternative 3. Baseline FSDM Program | Swine Hunting<br>This alternative would have greater adverse effects on feral swine hunting opportunities than the Integrated FSDM Program in the short term because it allocates the most funding to operational FSDM. State territory and tribal regulations, enforcement, and management objectives for feral swine would remain the primary factor influencing feral swine hunting. APHIS's ability to provide technical assistance for use in development of feral swine regulations would be lower than the Integrated Program but greater than the Current Program.<br><br>Hunting other Game Species<br>Short term localized benefits to game species adversely affected by feral swine would be greater than the Integrated FSDM Program but ultimately would have lower long term positive impacts because of lower efficacy in meeting project objectives. Adverse effects on game animals would be negligible.<br><br>Aesthetic Values<br>Program effects would be similar to the Integrated FSDM Program but would be related to baseline funding |

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| | distribution. People who place intrinsic value on feral swine would be affected to the extent that populations are eliminated, but viewing opportunities would still remain in States that manage feral swine as a game species, or where eradication is not feasible or desired.<br><br>Disturbance to Recreationists<br>Increased operational control actions over the Current and Integrated FSDM Programs would increase the potential for disturbance in more areas. The recreating public may see or hear aircraft more than with other alternatives, however flight time and potential exposure is still estimated to be low. The public would have slightly more exposure to temporary warning signs and equipment however for the reasons discussed under Current and Integrated FSDM Programs, exposure is still expected to be low. Land management agencies may temporarily close recreational facilities more frequently based on broader scale operations. Coordination with land managers and use of protocol (SOPs) for minimizing disturbance would help to minimize disturbance to outdoor recreationists. |
| Alternative 4. National FSDM without Baseline Funding | Swine Hunting<br>Potential impacts would only occur in States with strategic local project and States identified as priorities for the national feral swine population and damage control effort. Impacts in areas where FSDM does occur may be more intensive because more resources may be allocated to these areas than under the other action alternatives. As resources and funding move from areas cleared of swine damage to new areas over time, more states, territories and tribes would see some effects. Hunting opportunities in States that manage feral swine as a game mammal would not generally be affected except in local areas if they received funding for strategic local projects.<br><br>State, territory and tribal regulations, enforcement, and management objectives for feral swine would remain the primary influence over feral swine hunting opportunities. APHIS's ability to provide technical assistance for use in developing management plans and regulations would be similar to the Integrated FSDM Program in priority states and similar to the Current APHIS FSDM Program in the remaining states.<br><br>Hunting other Game Species<br>Benefits to hunting of other game species would occur more rapidly than under the Integrated FSDM alternative in those States that were identified as priorities. Benefits overall would be based on long term efficiencies. States that have high feral swine populations or which do not intend to eradicate them may see benefits similar to the current program. |

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| | Aesthetic Values<br>In States, Territories and Tribal areas identified as priorities for national population management, impacts would be similar to or greater than the Integrated FSDM Program. The loss of the positive aesthetic value of feral swine in those locations would be minimal compared with the benefit to the natural environment from removing this invasive species. In States, Territories and Tribal areas which are not identified as national priorities, but which receive funding for strategic local projects, local impacts in the project areas would be Intermediate to the Integrated FSDM Program and Current FSDM Program. Impacts in all other areas would be similar to the Current FSDM Program.<br><br>Disturbance to Recreationists<br>States, Territories and Tribal lands identified as priorities for national projects would experience impacts similar to the Integrated FSDM Program. Impacts in the remaining areas would be similar to the Current FSDM Program although there may be some increases in impacts in areas where strategic local projects are conducted. Impacts in strategic local project areas would be similar to the Integrated FSDM Program. SOPs discussed under the current and preferred alternatives would limit potential exposure and disturbance to the recreating public. |
| Alternative 5 - Federal FSDM Grant Program | Swine Hunting<br>APHIS-WS would not directly affect feral swine hunting. The negative effects on feral swine hunters and hunting businesses (Section 4.C.9) would be greater than the Current FSDM Program, but lower than the other alternatives.<br><br>Hunting other Game Species<br>APHIS-WS would not directly affect other game animals. Benefits to hunters of other game species would probably be lower than under Alternatives 2, 3 and 4 but greater than the current program. State regulations, enforcement, and management objectives for feral swine would remain the single greatest influence over feral swine hunting opportunities. Information getting to those who influence legislation on feral swine management would be lower than all other action alternatives because APHIS-WS would only be indirectly involved in FSDM through issuance of grants.<br><br>Aesthetic Values<br>APHIS would not directly affect the aesthetic enjoyment of the natural environment. This alternative would benefit aesthetic aspects of the natural environment greater than the current program but less than the other alternatives. |

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| | Disturbance to Recreationists<br>APHIS would not cause direct disturbance to recreationists under this alternative. Because the grant program would require implementation of SOPs and other measures to minimize negative effects, the impacts would be related to the degree that grant recipients followed protocol established for resource protections. |
| **Effects on Climate Change** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | FSDM operations contribute a fraction of the 10,350 – 12,254 MT or less per year of $CO_2$-equivalent greenhouse gas emissions from all APHIS wildlife damage management programs.  This is well below the Council on Environmental Quality's suggested reference point of 25,000 MT/year of direct emissions for detailed analysis and potential mitigation in a proposed action. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | The Integrated FSDM Program would be likely to raise cumulative APHIS wildlife damage management program CO2-equivalent greenhouse gas emissions levels to 10,723 – 12,822 MT or less per year. However, this level would still be below the 25,000 MT threshold for detailed review proposed by CEQ. |
| Alternative 3. Baseline FSDM Program | Increases in program operations from baseline funding allocations would increase emissions over the Integrated FSDM Program but would not near the suggested reference point of 25,000 MT/year. |
| Alternative 4. National FSDM without Baseline Funding | Emissions would be similar or less than the Integrated FSDM Program. |
| Alternative 5 - Federal FSDM Grant Program | Emissions would be lower than the Integrated FSDM Program based on higher administrative functions, and lower available resources for operational FSDM. |
| **Effects on Human Health and Safety** | |
| Alternative 1. No Action Alternative | Firearms, aerial shooting and surveillance, snares, leg-hold traps, pyrotechnics used for hazing, cage traps, chemical repellants, carcass handling, and drugs have the potential to put some people at risk. Risks to the public are low for many reasons including safety policies, training and certification, coordination and agreements with |

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| (Current FSDM Program) | landowners and land managers, adherence to regulations and other program SOPs, and timing and location of the use of methods to minimize public exposure. No adverse effects on public safety have occurred from FY09 through FY13. Safety risks are greatest for APHIS-WS personnel implementing FSDM methods.<br>Feral swine are not likely to be donated to food charities because of regulatory and logistical constraints, but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks.<br>Information on risks from the injectable formulation of GonaCon™ was presented indicating low risk to the public. Other reproductive inhibitors and toxicants may be added to the alternative pending further analysis and NEPA decisions.<br><br>This alternative does not pose disproportionate risks to children (Executive Order 13045), or to minority and low-income populations (Executive Order 12898). FSDM is likely to benefit the public by reducing the potential for zoonotic disease transmission and swine-vehicle accidents. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | Risks associated with specific FSDM methods would be similar in nature to the Current FSDM program alternative but greater in extent because more funding will be available for operational FSDM. Factors which would help to minimize risks associated with FSDM methods would be similar to the Current FSDM Program but could be lower if the increased research conducted under this alternative identifies means to improve safety and efficacy of FSDM methods. Eliminating or reducing feral swine in many areas over time would further reduce the risk of zoonotic disease transmission such as brucellosis, trichinosis, tuberculosis, toxoplasmosis, E. coli and leptospirosis and further reduce risks of vehicle collision beyond current program.<br>Feral swine would not likely be donated to food charities but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks.<br><br>APHIS-WS is recommending the use of non-toxic shot over lead to the extent practicable.<br>No disproportionate adverse risks on children or minority and low-income populations were identified.<br>This alternative would improve national coordination on surveillance for zoonotic diseases and would improve the ability of health officials to identify and respond to disease risks.<br><br>Feral swine would probably not be donated to food charities because of regulatory and logistical constraints, but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks.<br><br>This alternative would increase baseline funding and associated benefits for all APHIS-WS state programs serving states, territories and tribes with feral swine. Benefits include decreased risk of disease transmission, collisions with |

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| | vehicles, encounters with aggressive swine and contamination of watersheds. This alternative would also be among the most effective in containing and reducing the national feral swine population and associated threats to human health and safety. |
| Alternative 3. Baseline FSDM Program | Risks associated with specific FSDM methods would be similar in nature to the Current FSDM program alternative but greater in extent because it would allocate the most funding to operational FSDM. However, this alternative does not provide additional funding for research which may improve the safety and efficacy of FSDM efforts. This program would also not provide national funding for outreach and education programs that could reduce health risks.<br><br>There would be more operational FSDM and associated benefits to human safety under this alternative in the short term. However, this alternative would be less effective in containing or reducing the national feral swine population. Consequently, the need for FSDM is likely to persist longer than under alternatives that use a strategic national approach to contain and reduce the feral swine population.<br><br>Feral swine would probably not be donated to food charities because of regulatory and logistical constraints, but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks. |
| Alternative 4. National FSDM without Baseline Funding | Risks and benefits associated with specific FSDM methods would be similar in nature to the Current FSDM program alternative but more uneven in extent because funding will only be allocated to APHIS-WS programs serving national priority states and states with strategic local projects. Benefits associated with containing and reducing the national feral swine population would likely be achieved more quickly under this alternative than under the remaining alternatives. However, in the interim, states which are low priorities for FSDM will receive little additional support for projects to protect human health and safety.<br><br>This alternative would have a nationally coordinated research component which could help to improve the efficacy and safety of FSDM methods. It would also increase outreach and education efforts which could help inform the public and agencies of ways to minimize safety risks associated with feral swine.<br><br>Feral swine would probably not be donated to food charities because of regulatory and logistical constraints but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks. |
| Alternative 5 - Federal FSDM Grant Program | Impacts of this alternative would be similar to the Integrated FSDM Program but lower in magnitude because of increased administrative costs and reduced funding available for FSDM. This alternative will also be less effective in reducing feral swine threats to human safety because of reduced national coordination for FSDM activities and |

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| | international planning.<br>Feral swine would not likely be donated to food charities but carcasses may be provided to landowners along with advice on precautionary measures to avoid health risks. |
| **Sociocultural Effects** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | <u>Cultural Resources</u><br>Other than carcass burial and installing fence posts, the Current FSDM Program Alternative does not generally have the potential to adversely affect historic properties. Consultations with SHPO, THPO or other tribal representatives, may be necessary and sites would be relocated to avoid adverse effects on potential historic resources. When APHIS-WS is requested by resource managers to protect historic or other cultural resource sites from feral swine damage, APHIS-WS would coordinate with SHPO, Tribes, and requesting agency experts to ensure that NHPA requirements are met. Federal land management agencies may take the lead in Section 106 compliance.<br><br><u>Impacts on Tribes, Traditional Cultures and Ceremonial Values</u><br>Tribal perspectives on feral swine vary but are similar to those of the general public. Early outreach, coordination and consultation with Tribes during the development of APHIS-WS state and local level NEPA documents helps ensure that tribal management objectives and issues are included in planning, and that adverse effects are low. No work is done on tribal lands without written approvals from the Tribe. APHIS-WS is assisting the Mescalero Apache Tribe in New Mexico in the statewide effort to eradicate feral swine. With few other exceptions, assistance to Tribes in managing feral swine damage under this alternative is limited due to financial constraints.<br><br>Feral swine have cultural, religious, and ceremonial importance in Hawaii and the Pacific Island Territories. In Hawaii, feral swine are not removed from public hunting areas where they are managed as game mammals. Removals could reduce availability on some private lands. Carcasses may be provided for personal use to private landowners where the swine are killed.<br><br><u>Humaneness and ethical perspectives</u><br>The analysis shows that the current FSDM program is both ethical and humane at the local (State, Territorial, Tribal) level. At the National level, because of reduced efficacy and limited resources, is not as effective in meeting some criteria used for evaluating ethics for the alternatives. The current FSDM program is likely to be acceptable or insufficient to those who believe that feral swine are an invasive species that are destructive and require control. Those who may object to the current program on the grounds of ethics or humaneness would include people who |

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| | believe that any wildlife control is wrong, those who object to lethal or nonlethal control, and those who object to current APHIS activities. |
| Alternative 2. Integrated FSDM Program – Preferred Alternative | Cultural Resources<br>Adverse effects would be similar in nature to the current FSDM program because of similarity in methods and SOPs, but would be more extensive because of increased FSDM activity.<br>Additional coordination is likely to be needed based on expanded work areas and the potential to increase the use of on-site carcass burial. Benefits to cultural resources from FSDM are likely to increase. Section 106 compliance may be conducted in tandem with APHIS-WS state and local NEPA processes.<br><br>Impacts on Tribes, Traditional Cultures and Ceremonial Values.<br>Additional resources beyond the current program would be available to assist Tribes with reducing feral swine damage and populations of feral swine would be either eliminated or reduced. Effects of FSDM on Tribes would be similar to the current program but outreach and coordination would increase in magnitude and scope. Conflicts between Tribes and States could arise where states wanted to eliminate feral swine but Tribes within those states wanted to retain them on tribal lands or *vise versa*. APHIS-WS would identify these conflicts in early project planning to work with affected parties to identify solutions.<br>Expanded removals in Hawaii and other areas where feral swine have important traditional uses would not affect public hunting because of existing SOPs to preserve hunting opportunities on public lands but could further reduce availability on private lands over current FSDM program levels. Efforts to protect native and endangered species and their habitats would likely increase which may benefit other traditional and cultural values.<br><br>Humaneness and ethical perspectives<br>People's perceptions of the program would be as presented under the Current FSDM Program because of the similarity in methods available but may be heightened based on increased activities. Research would accelerate the development and possible registration of chemical methods. Most people would probably accept an effective and selective reproductive control method, but some would object to the use of toxicants being used in the future. This alternative may be the most ethical and humane based on the models used for analysis. Agency partners and others who participate with this alternative may request additional discussion based on State regulations and their respective program policies relating to humaneness and ethics, which could result in development of additional guidance and APHIS-WS SOPs at the project level. |
| Alternative 3. | Cultural Resources |

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| Baseline FSDM Program | The potential for adverse and beneficial effects may be initially higher than the Integrated FSDM Program because this alternative allocates more funds to operational FSDM. SOPs and Section 106 procedures would be similar to Integrated program. Long term benefits to cultural resources are likely to be lower than the Integrated FSDM Program because of the lack of a strategic national approach to address large scale feral swine population problems.<br><br><u>Impacts on Tribes, Traditional Cultures and Ceremonial Values.</u><br>Additional resources beyond the Integrated FSDM Program may be available for working with Tribes in States with eradication goals, and those with large numbers of feral swine. Some States with low populations that might be identified as national priority States under the Integrated, National without Baseline, and Federal Grant FSDM Programs may get less funding under this alternative because funds are allocated based on the size of the feral swine population. Consequently, FSDM is likely to take longer or be less effective in assisting Tribes in states with smaller and moderate feral swine populations. Other effects would be similar to the Integrated FSDM Program and outreach and coordination would expand accordingly.<br><br><u>Humaneness and Ethical Perspectives</u><br>This alternative would be more ethical and humane than the Current FSDM Program based on improved FSDM capacity over the current program, but less than the Integrated FSDM Program based on lack or only minimal research, outreach/education and technical assistance on local regulations. As with the Integrated FSDM Program, agency partners and others who participate with this alternative may request additional discussion based on their respective program policies relating to humaneness and ethics, and additional guidance may be added to APHIS-WS SOPs at the project level. |
| Alternative 4. National FSDM without Baseline Funding | <u>Cultural Resources</u><br>Some States with high feral swine populations which do not intend to eradicate feral swine may continue to experience damages. Benefits would be seen where strategic local projects are funded. Adverse effects would be low, similar to the Integrated FSDM based on SOPs. Long term benefits in terms of national feral swine population control, would be highest based on overall efficiencies.<br><u>Impacts on Tribes, Traditional Cultures and Ceremonial Values.</u><br>Impacts on Tribes would be similar to the Integrated FSDM Program with the exception that resources will be allocated to different areas. There may only be limited or no funds to work with Tribes on FSDM in areas which are not identified as national priorities. However, Tribes could work with State APHIS-WS programs to apply for strategic local project funding in the same manner as states and Territories. Impacts in strategic local project areas |

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| | would likely be intermediate to Alternatives 1 and 2.<br><br><u>Humaneness and ethical perspectives</u><br>This alternative would be more ethical and humane than the current FSDM program based on improved FSDM capacity over the current program and Baseline FSDM program, but less than the Integrated FSDM Program based on reductions in efficacy associated with reductions in baseline FSDM capacity in all States with feral swine. As with the Integrated FSDM Program, agency partners and others who participate with this alternative may request additional discussion based on their respective program policies relating to humaneness and ethics, and additional guidance may be added to APHIS-WS SOPs at the project level. |
| Alternative 5 - Federal FSDM Grant Program | <u>Cultural Resources</u><br>APHIS would not directly affect cultural resources. APHIS would be responsible for ensuring that grant recipients followed any applicable SOPs and Section 106 protocols. Adverse effects should be low as long as grant recipients followed conditions of the grant. Benefits to cultural resources are likely to be greater than the Current FSDM Program, but lower than all other alternatives.<br><br><u>Impacts on Tribes, Traditional Cultures and Ceremonial Values.</u><br>Tribes would not work directly with APHIS-WS but partnerships among Tribes and other agencies would be encouraged. Tribal governments and Native Hawaiian organizations would be able to apply for grants to protect their own resources.<br><br><u>Humaneness and ethical perspectives</u><br>Grants would be allocated to fund the same type of FSDM activities as described under the Integrated FSDM Program. Consequently perceptions of the humaneness and ethics of this alternative will be similar to alternative 2 but may be less acceptable to some individuals because of the reduced efficacy of the alternative and because there is some uncertainty regarding Grant recipient commitments to implementing the SOPs and other protective measures outlined for APHIS-WS under alternatives 1-4. |
| **Economic Effects** | |
| Alternative 1. No Action Alternative (Current FSDM Program) | Damage management and eradication is largely dependent upon cooperator funding. Assistance to low income landowners and communities is limited. Crop damage prevented is estimated to be approximately $7.1 million. Hunting preserves, other hunting related business and private pest control operators that control feral swine see some economic benefit from current feral swine populations. They are not likely to be adversely affected by current feral swine removal rates. |

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| Alternative 2. Integrated FSDM Program – Preferred Alternative | Increased funding, cost share, partnering, systematic program application, international coordination, research on chemical methods, education and outreach and program monitoring would be likely to provide long term beneficial economic effects from increased efficiencies in FSDM and reduced feral swine damages. Low-income landowners and communities would receive more FSDM benefits than the Current FSDM Program.<br>This alternative may prevent between $16.4 million to $23.5 million in crop damage per year, but these benefits would vary depending on a number of factors including the phase of the programs and where they are located.<br>Feral swine sport and hunting businesses, private pest control operators, and people who use feral swine for food could be negatively affected in the long term except where feral swine are not managed as a game animal.<br>Businesses that supply FSDM equipment and supplies would initially benefit from increased sales but long term program success would reduce purchases over time.<br>Legal fenced hunting preserves could benefit by having less competition from reduced or eliminated feral swine populations nearby. |
| Alternative 3. Baseline FSDM Program | Baseline funding is allocated strictly on the size of the existing feral swine populations. Cost inefficiencies are likely to result from lack of surveillance and population monitoring, funding delays, lack of projects to address special local and national needs, the inability to adjust and increase resource allocations when few feral swine remain in a State; and when rapid response is needed to control emerging populations. These factors would increase the costs of removal efforts over time.<br><br>Research and registration of new effective and efficient chemical methods would not proceed above current program levels.<br>Disease monitoring similar to the current program would continue with fewer benefits than the Integrated FSDM Program.<br>Crop damages alleviated would be greater than the Current FSDM Program, and could be greater at first compared with the Integrated FSDM Program because funding would not be allocated to National priorities that focus beyond immediate damage control. In the long term, this alternative would be less effective at reducing crop damages because it would be less effective in containing and reducing the national feral swine population.<br><br>Economic impacts on swine hunting, hunting preserves, damage management businesses and individuals who use swine for supplemental food would be greater than the current program, but slightly lower than the national FSDM program, with the greatest impacts being in areas with large feral swine populations that receive the most funding.<br>Increased cost share partnerships that the State and Territorial level would increase the capacity of agencies, Tribes and land owners/managers to address feral swine damage but because of reduced efficiencies, could make it |

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| | extremely difficult to achieve eradication goals in some areas. |
| Alternative 4. National FSDM without Baseline Funding | Long term efficiencies to support eradication would increase with this alternative as a result of the increased funding for research, national-level education and outreach programs, national disease monitoring, and national and international project coordination, and with eliminating feral swine from some key areas more rapidly than with other alternatives.<br>Benefits of this alternative would be tempered by an inability to address ongoing damage or stabilize populations in areas which do not receive national FSDM funding because they are not identified as strategic priorities for FSDM.<br><br>Economic impacts on swine hunting and associated revenues and benefits would be greater than the current program in priority project areas, and least likely of the action alternatives to affect some areas with high populations because most will initially be low priority for national population control efforts.<br><br>Negative effects on feral swine associated income and benefits would inversely correlate to economic effects from hunting game species adversely affected by feral swine.<br><br>Crop damages avoided would be greater than the current program in priority project areas. In the short term there will be less damage management in low priority states until FSDM objectives are achieved in other states and funding shifts. |
| Alternative 5 - Federal FSDM Grant Program | Less effective and efficient elimination of feral swine would prolong damages and associated lost revenue and take longer to meet national objectives. Some aspects of the national projects could be implemented by grant recipients, but overall, the national efforts to increase efficiencies (research, education/outreach, monitoring and international collaboration) would be reduced or eliminated and thus would provide less benefit while costing more over time because of administrative expenses.<br><br>Economic impacts on feral swine related hunting pursuits would be greater than the Current FSDM Program, and less than the remaining alternatives, with inverse effects on hunting revenues and food related benefits from game species adversely affected by feral swine.<br><br>Less funding would reach FSDM because overhead would be highest under this alternative. Long term costs would be most likely to persist compared with the other action alternatives.<br><br>Crop damage avoided would be greater than the Current FSDM Program, and lower than the Integrated and |

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| | Baseline FSDM Programs. Compared with the Integrated FSDM Program without Baseline Funding, more crop damage may initially be prevented, but over time it would be less based on reduced efficiencies. |
| Cumulative Effects | The existing environment which identifies and defines the potentially affected environmental issues and resources raised during scoping (Chapter 3) represents the aggregate impacts of past actions. The alternatives are nationwide in scope and could extend in theory to any location where feral swine may occur presently or in the foreseeable future. While the scope is national (including territories and tribal lands), the actual individual project locations would be relatively small and widely dispersed because they are based on the locations and densities of feral swine that are not desired by State/Territorial/Tribal or local authorities. The preferred action would guide resource allocation and establish a plan of actions to achieve nationally established goals and objectives for FSDM (Section 1.H.).<br><br>Most individual feral swine damage management projects typically have minimal impacts that are of short-duration and would not be expected to contribute significantly to cumulative impacts because the potential for adverse effects on the environment has already been mitigated through following laws, regulations, program policies, SOPs, and through cooperation with resource management experts. In addition, because APHIS does not manage affected resources or feral swine, it conforms to applicable State, Territorial and Tribal government laws for environmental protection. Finally, when APHIS cooperates with other federal agencies, it follows cooperating and partner agency policies and rules for environmental protection as defined in MOUs, work plans and other agreements. Specific cumulative effects for each affected resource are discussed under Section 4. H. |

# Appendix A: Acronyms

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|---|---|
| AFWA | Association of Fish and Wildlife Agencies |
| ANG | Air National Guard |
| APHIS | Animal and Plant Health Inspection Service |
| APHIS-IS | USDA International Services |
| APHIS-VS | USDA Veterinary Services |
| APHIS-WS | USDA Wildlife Services |
| ARPA | Archaeological Resources Protection Act |
| AVMA | American Veterinary Medical Association |
| BLM | Bureau of Land Management |
| CDC | Center for Disease Control |
| CDFW | California Department of Fish and Wildlife |
| CEQ | Council on Environmental Quality |
| CFR | U.S. Code of Federal Regulations |
| CNMI | Commonwealth of Northern Mariana Islands |
| CSF | Classical Swine Fever |
| DEA | U.S. Drug Enforcement Administration |
| DEIS | Draft Environmental Impact Statement |
| DNA | Deoxyribonucleic Acid |
| DOI | United States Department of Interior |
| DOJ | U.S. Department of Justice |

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| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act of 1973 |
| FAA | Federal Aviation Administration |
| FAD | Foreign Animal Disease |
| FAO | Food Agriculture Organization |
| FDA | U.S. Food and Drug Administration |
| FFWCC | Florida Fish and Wildlife Conservation Commission |
| FMD | Foot and Mouth Disease |
| FSDM | Feral Swine Damage Management |
| FWS | Fish and Wildlife Service |
| GPS | Global Positioning System |
| HAID | Hawaii Animal Industry Division |
| IAV-S | Avian Influenza A in Swine |
| ISAC | Invasive Species Advisory Committee |
| ISSG | Invasive Species Specialist Group |
| IUCN | World Conservation Union |
| IWDM | Integrated Wildlife Damage Management |
| IVMS | Institute of Medical and Veterinary Science |
| LPA | USDA Legislative and Public Affairs |

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| LWLF | Louisiana Wildlife and Fisheries |
| MDC | Michigan Department of Conservation |
| MDNR | Michigan Department of Natural Resources |
| MSU | Mississippi State University |
| NABCC | National Agriculture Biosecurity Center Consortium |
| NASDA | National Association of State Departments of Agriculture |
| NASS | National Agricultural Statistics Survey |
| NEPA | National Environmental Policy Act of 1969 |
| NICS | National Invasive Species Council |
| NISC | National Invasive Species Council |
| NOAA | National Oceanic and Atmospheric Administration |
| NPS | National Park Service |
| NRCS | USDA Natural Resources Conservation Service |
| NWDP | National Wildlife Disease Program |
| NWRC | National Wildlife Research Center |
| NYSCEC | New York State Department of Environmental Conservation |
| PEDV | Porcine Epidemic Diarrhea Virus |
| PRV | Pseudorabies Virus |
| ROD | Record of Decision |
| SCWDS | Southeastern Cooperative Wildlife Disease Study |
| SHPO | State Historic Preservation Officers |
| SOP | Standard Operational Procedure |

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| TPW | Texas Parks and Wildlife |
| UK | United Kingdom |
| US | United States |
| USC | US Code |
| USDA | US Department of Agriculture |
| USDI | US Department of the Interior |
| USGS | US Geologic Survey |
| USFS | US Forest Service |
| USITC | US International Trade Commission |
| USTR | US Trade Representative |
| WDM | Wildlife Damage Management |
| WWHC | Western Wildlife Health Committee |

# Appendix B: Literature Cited

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# Appendix C

# Preparers, Contributors and Reviewers

## A. APHIS Preparers, Contributors and Reviewers

**David A. Bergsten**
Supervisory Biological Scientist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Environmental Science
M.S. Entomology
M.P.H. Disease Control
Ph.D. Toxicology
Experience: Expertise in environmental toxicology, chemical fate, and pesticide research. More than 26 years of experience with APHIS including environmental compliance, field operational programs, and port inspection work. Experience in preparing environmental documentation for major APHIS programs in compliance with Federal statutes.

**Michael J. Bodenchuk**
State Director – Texas
USDA-APHIS-WS
San Antonio, TX
B.S. Wildlife Science
Post graduate Coursework NMSU
Experience: 24 years wildlife damage management experience with USDA-APHIS-WS including 17 years designing programs specific to predation management and feral swine management as a State Director. Conducted feral swine projects in 3 states and in Australia as a visiting scientist. 7 years private sector experience in Texas including land management and consulting biologist. Conducted wildlife management projects (including feral swine management) in Texas, New Mexico and Sonora, MX. Experience preparing state-level NEPA analyses in South Dakota, North Dakota, Utah and Texas.

**Fred L. Cunningham**
Supervisory Research Biologist, Field Station Project Leader
B.S. Animal Science
M.S. Animal Science, Swine Reproduction and Endocrinology
DVM
Experience: 14 years of experience as consultant for swine producers. Owned swine production system with farms in 6 Midwestern states. 5 years as Clinical Instructor Mississippi State University. Experience with domestic animal, livestock and wildlife disease management and

epidemiological modeling, risk assessment, database development, RIA development, laboratory research, and study development.

**Paul Michael Darby**
Economist
USDA/APHIS/PPD/PAD
Riverdale, MD
Ph.D. Agricultural Economics
Experience: Agricultural Economist with experience in natural resource and policy economics. Six years of service working on multimillion dollar federal research grants at a land grant university specializing in bioenergy, forest economics, and economic modeling. APHIS responsibilities include assessing expected economic effects of proposed APHIS actions and providing economic expertise, information, and analysis in support of the APHIS mission.

**Samantha Bates Floyd**
Biological Scientist
Environmental and Risk Analysis Services
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
M.S. Environmental Science and Policy
Experience: Biological Scientist in Environmental and Risk Analysis Services with expertise in pesticide research and regulatory policy. Over ten years of service with APHIS. Experience in managing environmental compliance as it relates to the Federal Insecticide, Fungicide, Rodenticide Act and prepares and provides assistance on environmental documents for APHIS programs.

**Michelle L. Gray**
Environmental Protection Specialist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
M.S. Zoology
Experience: Environmental protection specialist with expertise in wildlife biology and toxicology. Eleven years of service in APHIS. Experienced in preparing environmental documents for APHIS programs. Experienced in environmental compliance especially as it relates to the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, and the Endangered Species Act. Experienced with Tribal consultation, environmental justice, and the National Historic Preservation Act.

**Thomas C. Hall**
Staff Wildlife Biologist
USDA-APHIS-WS
Fort Collins, CO
B.S. Biology (Natural History)

B.A. Psychology
M.S. Wildlife Ecology
Experience: Special expertise in wildlife biology, ecology, and damage management . Twenty nine years of service in APHIS Wildlife Services including operations and research conducting a wide variety of programs (bird damage research, livestock protection, invasive species management, wildlife hazard management at airports, natural resource protection, and feral swine and beaver damage management in the field and office. Experienced in preparing environmental documents for WS programs to comply with the National Environmental Policy Act, the Bald and Golden Eagle Protection Act, and the Endangered Species Act.

**Shannon M. Hebert**
Staff Biologist, Project Co-lead
USDA-APHIS-WS
Portand, OR
B.S. Animal Science
M. S. Agricultural Science
Experience: 25 years professional experience in federal interdisciplinary environmental compliance with focus on natural and agricultural resource management. 19 years with APHIS WS as environmental coordinator with expertise in NEPA, ESA, and other environmental statutes, regulations and policies governing wildlife damage management.

**Beth E. Kabert**
Staff Wildlife Biologist
USDA-APHIS-WS
Pittstown, NJ
B.S. Wildlife Biology
Experience: Expertise in wildlife damage management. Over 15 years of service with APHIS-Wildlife Services. More than 9 years involved with field program wildlife damage management operations including wildlife disease management and more the 6 years preparing and reviewing National Environmental Policy Act compliance documents.

**Dwight J. LeBlanc**
State Director, Louisiana
USDA-APHIS-WS
Port Allen, LA
B.S. Wildlife Management,
M.S. Wildlife Biology
Experience. State Director, USDA Wildlife Services with in addressing wildlife conflicts. Over 35 years of experience with managing and conducting operational wildlife damage projects; cooperating with State and Federal regulatory agencies; field testing bird repellents and damage management tools; and preparing environmental documents, including ESA Section 7 support information. Certified Wildlife Biologist

**Erica McDonald**
Staff Biologist
USDA-APHIS-WS
Tacoma, WA
B.S. Wildlife Science
<u>Experience</u>: Wildlife biologist for 10 years with APHIS-WS program specializing in wildlife damage management; including field programs such as wildlife hazard management at airports, natural resource protection, and disease surveillance in the field. Experienced in the preparation of environmental documents for WS programs to comply with the National Environmental Policy Act and the Endangered Species Act.

**Vivian A. Miller**
Environmental Protection Specialist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
M.Ed. Secondary Education, Biology
<u>Experience:</u> Environmental protection specialist with more than four years of experience in preparing and reviewing NEPA compliance documents for APHIS.

**Dale L. Nolte**
Program Manager – APHIS National Feral Swine Damage Management Program
USDA/APHIS/WS
Fort Collins, CO
B.S. Range Ecology
M.S. Range Science
PhD Range Science with emphasis on animal behavior
<u>Experience</u>: Wildlife biologist with experience developing animal damage techniques and approaches to reduce damage to forest resources and aquatic mammal, conducted research to address invasive species, WS/NWRC mammal research program manager, WS international liaison, WS emergency management, WS Assistant Coordinator for NWDP with responsibility for feral swine disease monitoring activities, coordinate APHIS feral swine operations, research, and disease monitoring

**Daniel L. Smith**
Environmental Protection Specialist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
B.A. Chemistry
M.S. Environmental Science
<u>Experience:</u> U.S. Army Corps of Engineers, 2000-2008. USDA-APHIS, 2008 to present with experience in Geographic Information Systems and map preparation.

**Stephanie Holmes Stephens**
Biological Scientist
Environmental and Risk Analysis Services
USDA/APHIS/PPD/ERAS
Park City, UT
B.A. Biology
M.S. Environmental Management
Experience: Biological Scientist in Environmental and Risk Analysis Services with expertise in regulatory policy and environmental compliance. Twelve years of service with APHIS. Experience in preparing and managing National Environmental Policy Act documents. Experience in managing pesticide registration projects for conventional and biochemical pesticides. Experience in managing animal drug approvals.

**Kimberly K. Wagner**
Staff Wildlife Biologist, Project Co-lead
USDA-APHIS-WS
Sun Prairie, WI
B.S. Wildilfe Ecology
M.S. Wildlife Biology
Ph.D. Wildlife Ecology
Fellow – Berryman Institute for Wildlife Damage Management
Experience: Expertise in wildlife damage management. Over 5 years experience in wildlife damage management research with USDA-APHIS-National Wildlife Research Center. Over 12 years experience preparing environmental documentation for APHIS-WS program in compliance with Federal statutes.

**Fan Wang-Cahill**
Environmental Health Specialist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
M.S. Hydrobiology
Ph.D. Botany (Ultrastructure/Cell Biology)
Experience: Joined APHIS in 2012, preparing human health risk assessments and providing assistance on environmental compliance. Prior experience before joining APHIS includes 18 years environmental consulting experience specializing in human health risk assessments for environmental contaminants at Superfund, Resource Conservation and Recovery Act (RCRA), and state-regulated contaminated facilities.

**Jim E. Warren**
Environmental Toxicologist
USDA/APHIS/PPD/ERAS
Little Rock, AR
B.S. Forest Ecology

M.S. Entomology
Ph.D. Environmental Toxicology
Experience: More than seven years of experience working for APHIS preparing ecological risk assessments and providing assistance on environmental compliance. Prior experience before joining APHIS includes other government and private sector work regarding ecological risk assessments related to various environmental regulations.

**Tracy A. Willard**
Ecologist
USDA/APHIS/PPD/ERAS
Riverdale, MD
B.S. Biology
M.S. Entomology
Ph.D. Entomology
Experience: Ecologist in Environmental and Risk Analysis Services. Thirteen years of service with APHIS. Experience in environmental compliance, especially as associated with the Endangered Species Act and the National Environmental Policy Act.

## B. Cooperating Agency Contributors and Reviewers

Jessica Resnik
Wildlife Biologist, Invasive Animals Program Coordinator
National Park Service
NRSS-BRMD Wildlife Conservation Branch
1201 Oakridge Dr. Suite 201
Fort Collins, CO 80525

Glenn Plumb
Chief Wildlife Biologist
National Park Service
Biological Resource Management Division
Wildlife Conservation Branch
1201 Oak Ridge Drive, Suite 200
Fort Collins, CO 80525

Hank Henry, *Certified Wildlife Biologist®*
East Region Wildlife Biologist
NRCS - East National Technology Support Center
2901 East Lee Street, Suite 2100
Greensboro, NC 27401

John A. Sinclair

Assistant National Wildlife Program Leader
Watershed, Fish, Wildlife, Air and Rare Plants
USDA Forest Service
201 14th Street, SW
Washington DC 20250

Bob Duncan
Association of Fish and Wildlife Agencies
Executive Director
Virginia Department of Game and Inland Fisheries
4016 West Broad Street
PO Box 11104
Richmond, VA 23230

Gray Andersen
Assistant Chief Wildlife and Forestry Division
Association of Fish and Wildlife Agencies
Tennessee Wildlife Resources Agency
PO Box 40747
Nashville, TN 37204

Richard Smith
Region 8, Refuge Planning
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-1832
Sacramento, CA 95825

John Klavitter, M.Sc.
National Invasive Species Coordinator
Branch of Wildlife Resources, National Wildlife Refuge System
U.S. Fish and Wildlife Service, Headquarters
5275 Leesburg Pike
Falls Church, VA 22041-3803

Andree Duvarney, National Environmental Coordinator
USDA-NRCS
14th and Independence Ave, SW
Room 6158-S
Washington, DC 20250

Troy Bigelow, DVM
Staff Veterinarian
USDA/APHIS/VS/SPRS
Des Moines, IA

210 Walnut Street
Des Moines, IA 50309

Doug Eckery, PhD
Project Leader – Fertility Control
National Wildlife Research Center
USDA APHIS Wildlife Services
4101 LaPorte Avenue
Fort Collins, CO  80521

Toni Piaggio, Ph.D.
Research Scientist, Wildlife Genetics
National Wildlife Research Center
USDA APHIS Wildlife Services
4101 LaPorte Ave.
Fort Collins, CO 80521

# Appendix D

# State and Territory Information on Feral Swine Management

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# Appendix D: State and Territory Information on Feral Swine Management

APHIS seeks to reduce feral swine damage to agriculture, natural resources, property, animal health, and human health and safety in the United States and Territories in a manner consistent with State, Territorial and Tribal management objectives for the species. However, variation among States and Territories in regulations and management practices for feral swine also complicates efforts to reduce or eliminate feral swine populations. In, 2013, APHIS-WS asked states for information on their regulations and other feral swine management practices to aid our understanding of the status of feral swine in the country and the issues which will need to be addressed by a national feral swine management program. Responses were provided by a combination of state agencies and APHIS-WS state personnel.

**Table 1.** State and Territorial Regulations Relevant to Feral Swine Management

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Alabama | Feral swine on the hoof in the wild regulated by Alabama Department of Game and Fish; Feral swine in personal possession or trapped regulated by Alabama Department of Agriculture and Industries | Game animal until dead or trapped, then livestock | All pigs outside captivity considered wild pigs | Yes |
| Alaska | Alaska Department of Fish and Game (ADFG) | Deleterious exotic wildlife | State regulations 5 AAC 92.029. Owner has 48 hours to capture escaped animals. After 48 hours, owner must obtain permit from ADFG. If animals cannot be caught, ADFG will most likely destroy them or try to.<br><br>Sections (a), (b), and (d) mostly relate to feral swine. | No; any *Sus scrofa* can be moved if contained in a pen. Border inspectors would not be able to tell the difference between domestic and feral swine. |

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Alaska (cont.) | | | Pigs (*Sus scrofa* var.) may be possessed, imported, etc. and kept on private land, but not released to the wild without a permit from ADFG. | |
| American Samoa | No Response (NR) | (NR) | (NR) | (NR) |
| Arizona | Arizona Department of Agriculture (ADA);<br>Tribes | Excluded from livestock list | No | ADA regulation only states “swine” which is interpreted as including feral swine |
| Arkansas | Arkansas Livestock and Poultry Commission; Unofficially enforced by Arkansas Game and Fish (ARGF); ARGF regulates hunting (not backed by regulatory authority) | Livestock | Yes, state laws | Yes, state laws & APHIS regulations |
| California | California Department of Fish and Wildlife | Game mammal | Once escaped, considered wild pigs | APHIS regulations on interstate movement of "domestic" swine; California Department of Food and Agriculture regulations for intra-state movement of swine |

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Colorado | Colorado Parks and Wildlife; Colorado Department of Agriculture | No official status | Title 35 Article 43-125. No swine allowed to run at large. Owner is responsible for three times the cost of damage plus fine. | Yes |
| Connecticut | Connecticut Department of Agriculture | Domestic species | State has the authority to dispose of feral swine under CGS 22-278. | Yes, CGS 22-278 |
| Delaware | Delaware Division of Fish and Wildlife; Delaware Department of Agriculture | Invasive | Yes, Title 7 -3900 Wildlife Section 23.2.2 Feral Swine | Yes, Title 7 -3900 Wildlife Section 23.2.2 Feral Swine |
| Florida | Florida Fish and Wildlife Conservation Commission: Florida Department of Agriculture and Consumer Services | Wildlife with no restrictions on private land. Some wildlife management areas have restrictions/regulations | No | Yes, must be registered as a feral swine dealer and carry an ID card, keep thorough records, and follow several regulations |
| Georgia | Georgia Department of Natural Resources, Wildlife Resources Division; Georgia Department of Agriculture | Feral swine generally considered invasive species in Georgia; however legal definition is as follows: O.C.G.A. § 27-1-2 (28) "Feral hog" means any hog which is normally considered domestic but which is living in a wild state and cannot be claimed in private ownership | Escaped domestic swine fall under statute O.C.G.A. § 4-3-1 through § 4-3-12. Feral swine are not addressed. | Yes, Georgia Department of Agriculture rule 40-13-2-.09 and statute O.C.G.A. § 27-2-31 |

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Guam | Guam Department of Agriculture - Division of Aquatic & Wildlife Resources | Game and invasive | Yes, GCA and Title 9 GAR Chapter 11, hunting regulations | Yes, territorial vet issues permits for any entry into Guam. |
| Hawaii | Hawaii Department of Land and Natural Resources - Division of Forestry and Wildlife | Game especially within state-owned public hunting areas. Often treated as unregulated nuisance on private lands and invasive especially in designated natural areas, national parks and private preserves. | No regulations that govern controlling the wild type swine. HRS Chapter 142 address livestock fencing, being at large, etc. | SOH-DOA Quarantine Order No. 54-A (2002): no feral swine shall be permitted to leave any island, or enter any domestic swine facility for any purpose; SOH-DOA Quarantine Order No. 87 (2000) and 87-A (2008): (concerns of bovine tuberculosis transmission) no live feral swine or axis deer originating from east of Kamalo Stream, Molokai, shall be permitted to move out of this area without the prior written authority of the State Veterinarian. |
| Idaho | Idaho State Department of Agriculture; Idaho Department of Fish and Game | Invasive Species | Yes, Idaho State Department of Agriculture and Idaho Department of Fish and Game | Yes, Idaho State Department of Agriculture and Idaho Department of Fish and Game |
| Illinois | Illinois Department of Natural Resources | Damaging Invasive | Yes | Yes, state allowed with permit and health certificate |

| *State/ U.S. Territory* | *State agency(ies)/dept.(s) with management and regulatory authority for feral swine* | *Designated Legal Classification/Status of feral swine* | *Are there regulations to address escaped domestic or "wild type" swine?* | *Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?* |
|---|---|---|---|---|
| Indiana | Indiana Department of Natural Resources - Fish & Wildlife Division<br>Indiana Board of Animal Health | Exotic mammal, invasive species | Yes – Department of Natural Resources has regulations. No regulations from Board of Animal Health. | Yes |
| Iowa | Iowa Department of Natural Resources | Non-game, invasive species | Yes | Yes |
| Kansas | Kansas Department of Agriculture | Feral Livestock | Yes, 47-1809 | Yes, 47-1809 |
| Kentucky | Kentucky Dept. of Fish and Wildlife Resources | No formal legal classification but considered invasive pest | Yes | Yes |
| Louisiana | Louisiana Department. of Wildlife and Fisheries (LDWF); Louisiana Department of Agriculture and Forestry (LDAF) has jurisdiction on interstate movement | Outlaw Quadruped (LDWF); Considered livestock if in enclosed pen. Depends on definition. Widely accepted feral hog definition is they're feral if they lived any part of their life living free. | Only regulations are that it is illegal to release swine into the wild and LDAF law makes it illegal to free-range domestic swine. (LRS 3: 2891) | No intrastate restrictions. LDAF law requires ID,negative brucellosis and pseudorabies test and certificate of veterinary inspection prior to entry into state. Can't release in wild. (LRS 56:20) |
| Maine | Maine Department of Agriculture, Conservation and Forestry (MDA) | Stray Livestock | Yes, MDA Rules Chapter 223 | Yes, need permit for interstate movement, MDA Rules Chapter 206 |
| Maryland | Maryland Department of Natural Resources; Maryland Department of Agriculture | Livestock, pets | No, not directly | No, not directly |
| Massachusetts | Massachusetts Division of Fisheries and Wildlife | None | Yes, Massachusetts Department of Agriculture | Yes, importation permit required |

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Michigan | Michigan Department of Natural Resources | Nuisance invasive species | Yes, Animals Running at Large Act 328 of 1976, Section 433.14a | Yes, state law prohibits feral swine from entering Michigan |
| Minnesota | Minnesota Department of Agriculture | Eurasian wild pigs and hybrids thereof are a "restricted species" | Minnesota Statute 346.16 Running at large is defined and prohibited; Owner fined three times cost of damage. | Permits needed for import, production or movement of restricted species |
| Mississippi | Mississippi Department of Wildlife, Fisheries and Parks | Nuisance | No | Yes |
| Missouri | Missouri Department of Agriculture | Non-game, invasive species | Yes | Yes |
| Montana | Montana Fish, Wildlife & Parks | Illegal if Eurasian origin or hybrid thereof, no status if feral domestic | Montana Code Annotated 81-4-201 outlaws swine running at large | Yes, Administrative Rules of Montana 12.6.1541 |
| Nebraska | Nebraska Game and Parks; Nebraska Department of Agriculture | Nongame /Nuisance | Yes, state game laws | Yes, state game laws |
| Nevada | Nevada Department of Agriculture | Stray livestock | Yes, Nevada Revised Statute 569 | Yes, Nevada Revised Statute 569 |
| New Hampshire | New Hampshire Department of Agriculture, Markets and Food; New Hampshire Fish and Game Department | No defined status for feral swine but boar are defined as "Animals running at large" or escaped private property | No designation for feral swine but yes for escaped boar | No |
| New Jersey | New Jersey Division of Fish and Wildlife | No official classification yet established | Yes, New Jersey Statutes Annotated 23:4-63.3 and 63.4 | Yes, New Jersey Statutes Annotated 23:4-63.3 and 63.4 |
| New Mexico | New Mexico Livestock Board (only enforces current law) | No official designation | Yes, New Mexico Statute 77-18-6 | Yes, New Mexico Statute 77-18-6 |

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|---|---|---|---|---|
| New York | New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources | Not a domestic pig, invasive species | No, but bill passed legislature in June 2013 that awaits the Governor's signature to become law that addresses wild type swine | Bill awaiting Governor's signature will address movement of swine |
| North Carolina | North Carolina Wildlife Resources Commission; North Carolina Department of Agriculture and Consumer Services | Wild animal/ nongame animal | Yes, if the release is deliberate, G.S. 113-291.12 applies | G.S. 106-798 requires all swine being transported on a public road to be tagged. 15A NCAC 10B .0101 requires and importation permit for any wild animal brought into the state. G.S. 113-274 requires a transportation permit for wild animals. |
| North Dakota | North Dakota Board of Animal Health; Feral Swine Working Group: USDA-Wildlife Services, USDA-Veterinary Services, USDA-Forest Service, US Fish and Wildlife Service, North Dakota Department of Agriculture, North Dakota Game and Fish Department, North Dakota Department of Health | Stray livestock or illegally released/escaped non-traditional livestock | Yes. North Dakota Century Code Title 36 Chapter 11 "Trespass of Livestock" ; North Dakota Administrative Code 48-12-01.1 "Nontraditional Livestock" ; North Dakota Century Code Title 36 Chapter 26 "Feral Swine" | Yes. North Dakota Century Code Title 36 Chapter 26 "Feral Swine" |
| Northern Marianas Islands | Commonwealth of Northern Mariana Islands Division of Fish and Wildlife | Game animal and feral animal | Feral animal control is permitted, hunting of feral swine is permitted all year. | Yes, animal import/export |

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|---|---|---|---|---|
| Ohio | Ohio Department of Natural Resources, Division of Wildlife; Ohio Department of Agriculture | Game Quadruped | All free ranging *Sus scrofa* in Ohio are referred to as Feral Swine, gray areas do exist with known domestic escapes or pot-bellied pigs | Yes, OAC Chapter 901:1-17 Importation and Health of Animals: Non-domestic animals OAC 901:1-17-12 A (7) and Requirement for intrastate movement OAC 901:1-11-07 D (1-7) |
| Oklahoma | Oklahoma Department of Agriculture, Food, and Forestry | Invasive | Yes, any swine species "running at large or free roaming" is legally considered feral swine (Title 2, Chapter 1, Article 6, Section 6-603 of Oklahoma Statutes) | Import of live feral swine is prohibited unless moving directly to slaughter by permit. Live feral swine may only be transported intrastate by licensed transporters and may only be moved to a temporary holding pen, a licensed handling facility, licensed sporting facility, or slaughter plant (Title 2, Chapter 1, Article 6, Section 6-608 and 6-609 of Oklahoma Statutes). |

| ***State/ U.S. Territory*** | ***State agency(ies)/dept.(s) with management and regulatory authority for feral swine*** | ***Designated Legal Classification/Status of feral swine*** | ***Are there regulations to address escaped domestic or "wild type" swine?*** | ***Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?*** |
|---|---|---|---|---|
| Oregon | Oregon Department of Agriculture; Oregon Department of Fish & Wildlife | Predatory Animal per Oregon Revised Statutes 610 statute, feral swine are on the top 100 worse invasive species list | Yes, additional information and guidelines are available in the Oregon Feral Swine Action Plan and several Oregon Administrative Regulations (OARs) and Oregon Regulatory Statutes (ORSs) OAR 635-058-0000 OAR 635-058-010 OAR 635-058-0020 ORS-510-Fencing Against Hogs | Yes, Oregon Revised Statutes 498.052 |
| Pennsylvania | Pennsylvania Department of Agriculture (inside fences); Pennsylvania Game Commission/ Division of Natural Resources (outside fences) | Inside fence: livestock/agriculture; Outside fence: invasive nuisance species | No formal regulations, but new regulations pending. | APHIS regulations but no state regulations for intra- or interstate movement |
| Puerto Rico | Puerto Rico Department of Natural and Environmental Resources; Puerto Rico Department of Agriculture; Puerto Rico Department of Health | Exotic invasive species | No regulation to penalize owner for damages caused by escaped animal | Airport/harbor USDA regulations |
| Rhode Island | Not formally established. Department of Environmental Management, Division of Agriculture and Division of Fish and Wildlife | Unknown | Yes. Rhode Island General Law 4-14-1 and Rhode Island General Law 4-15-4 | Unknown |

| *State/ U.S. Territory* | *State agency(ies)/dept.(s) with management and regulatory authority for feral swine* | *Designated Legal Classification/Status of feral swine* | *Are there regulations to address escaped domestic or "wild type" swine?* | *Are there regulations that prohibit/restrict inter- or intrastate movement of feral swine in state?* |
|---|---|---|---|---|
| South Carolina | South Carolina Department of Natural Resources | Unclassified | South Carolina Code 47-7-10 et sec (dealing with estrays), South Carolina Code 50-16-25 (release, transport, etc), 50-11-710 (night hunting) | Yes, South Carolina Code 50-16-25 |
| South Dakota | South Dakota Game, Fish and Parks (GFP); South Dakota Animal Industry Board (AIB) | Not defined | No, but GFP's position to kill any of these animals. | Yes. South Dakota Administrative Rule 12:68:18:03. |
| Tennessee | Tennessee Wildlife Resources Agency; Tennessee Department of Agriculture | Species Deemed Destructive/Nuisance | No | Yes |
| Texas | Texas AgriLife Extension (authority for control of Russian Boars (synonymous with feral swine)); Texas Board of Animal Health (regulates movement and subsequent release of feral swine to prevent spread of disease); Texas Parks and Wildlife (requires general hunting license to take swine, issues aerial hunting permits, does research on swine impacts to wildlife); Texas Department of Agriculture (provides funding to Texas AgriLife Extension, funds bounty programs implemented by some counties); Texas Soil and Water Conservation Districts (manage on their properties and control swine impacts to soil and water) | Exotic Livestock | Uncontained swine are "exotic livestock" and managed in the same way as truly feral swine | Any swine entering state need a health certificate (not available for feral swine). Texas Animal Health Commission allows movement intrastate only to terminal slaughter or an approved holding facility (to await slaughter). Hogs may also be taken to approved shooting facility with "hog-proof fence". |

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|---|---|---|---|---|
| Utah | None | Stray Livestock, invasive species | No | No |
| Vermont | Vermont Fish and Wildlife Department; Vermont Agency of Agriculture, Food and Markets | Invasive species | No current, but in planning stages | Yes, Vermont Fish and Wildlife Department Statue 4709 |
| Virginia | Virginia Department of Agriculture and Consumer Services; Virginia Department of Game and Inland Fisheries | Livestock, Nuisance species, pest, agricultural animal, animal, non-commercial swine, domestic animal. | No | Yes |
| Virgin Islands | Virgin Islands Department of Agriculture; Department of Natural Resources | Stray livestock | Yes | Yes |
| Washington | WA Department of Fish & Wildlife (WDFW) | Invasive Species | No | No |
| West Virginia | West Virginia Division of Natural Resources (DNR) (hunting); West Virginia Department of Agriculture (WDA) (transporting in and out of state). Wild boar established in the 1970s by stocking Russian boar in southwest West Virginia managed by the DNR as a game animal in four counties; all other swine, feral or domestic, are regulated by WDA | Wild boar considered game animals with an established firearms and archery hunting season. Feral swine considered nuisance animals. | Yes, West Virginia State Law Chapter 19, Agriculture - Article 18: General Stock Law. WDA regulations only if they have proof of ownership | Yes, Title 61 Legislative Rule - Department of Agriculture - Series 1 - Animal Disease Control: Section 61-1-7.16 refers to Swine and regulates the importation of swine into the state |
| Wisconsin | Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection | Invasive species and a Harmful Wild Animal | Yes, NR 16.11, State Statutes 172.01 | Yes, NR 40 |

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|---|---|---|---|---|
| Wyoming | Wyoming Game and Fish Department (WGFD, primary); Wyoming Livestock Board (WLSB, secondary); Wyoming Department of Agriculture (WDA, secondary). Determining agency management and regulatory authority depends on whether swine are truly feral as per W.S. 11-48-101 or are species of swine other than domestic swine | Neither Wyoming Title 23 (Game and Fish) Statutes or Wyoming Game and Fish Commission (WGFC) Regulations have a definition of "Feral Swine", but there are definitions of "wildlife", "wild", "and domestic animals" that relate to the legal classification/status of feral swine. WGFC Chapter 10 Regulation for the Importation, Possession, Confinement, Transportati on Sale and Disposition of Live Wildlife prohibits the importation or possession of all members of the family Suidae, expect domestic swine and pot-bellied pigs, in Wyoming. The WDA statutes do not list feral swine as a predator species in Wyoming. | Feral livestock statute W.S. 11-48-101 and 102. WGFC Chapter 10 Regulation for the Importation, Possession, Confinement, Transportation Sale and Disposition of Live Wildlife | Yes, W.S. 11-18-103 AND 11-19-101. WGFC Chapter 10 Regulation for the Importation, Possession, Confinement, Transportation, Sale and Disposition of Live Wildlife |

**Table 2.** Legal Status, Management Plan Information, and Population Estimates by State/Territory

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Alabama | Game animal until dead or trapped, then livestock | Regulations depend on status of animal live or dead and where located when live | No, in development | Local damage control, long term eradication | Yes, but only on management areas. | Unknown population size but known range. | Statewide |
| Alaska | Deleterious exotic wildlife | Regulation 92.029 is ADF&G, Division of Wildlife Conservation’s primary regulation related to possessing “game”, which includes all wild or domestic and native or non-native mammals, birds, and reptiles | No | Control if reported | Not needed | None | None |
| American Samoa | (NR) | (NR) | (NR) | (NR) | (NR) | (NR) | (NR) |
| Arizona | Excluded from livestock list | None | No | Eradication | No | Unknown | Only in a few counties |
| Arkansas | Livestock | Act 1104 of 2013 "An Act Concerning Feral Hogs" | No | Eradication | Yes | Unknown | Statewide |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| California | Game mammal | California Code Title 14 Chapter 3 § 350.0 and § 368.0, § 401.0 | Yes | Game management and local control | Yes | Unknown | Statewide; 57 of 59 counties |
| Colorado | No official status | 2 CCR 406-0 Chapter W-0 Article 2 #002-K | No | Eradication | Yes | Unknown | Southeast portion of state |
| Connecticut | Domestic species | Connecticut Department of Agriculture CGS 22-278 | No | Remove as needed | No | Rare outbreaks | Not applicable |
| Delaware | Invasive | Title 7 -3900 Wildlife Section 23.2.2 Feral Swine | No | Eradication but to date no feral swine in state. Regulations are designed to prevent introduction | No | None known | None |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Florida | Wildlife with no restrictions on private land. Some wildlife management areas have restrictions/ regulations | Wildlife code 68A-1.004 and 68A-5.001 | No | Landowner/ manager preference | Florida Department of Environmental Protection-State Parks have some active control programs ongoing. None by other agencies | Unknown | Statewide except Florida Keys. |
| Georgia | Feral swine generally considered invasive species in Georgia; however legal definition is as follows: O.C.G.A. § 27-1-2 (28) " Feral hog" means any hog which is normally considered domestic but which is living in a wild state and | Georgia Department of Agriculture 40-13-2-.09/Feral Swine; Department of Natural Resources 391-4-2-.30/Feral Hog Hunting Weapons; O.C.G.A. § 27-3-24/Restrictions on hunting feral hogs; 27-3-13/Hunting of wildlife or feral hog from boats, aircraft, or motor vehicles; 27-1-2 (28)/Definitions | No | Invasive pest management | Yes, but only on specific state-owned properties | Unknown, but widespread and excessive in some areas | In nearly all counties |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| | cannot be claimed in private ownership | | | | | | |
| Guam | Game and invasive | Title 5 GCA Chapter 63 Article 1 Section 102 - Department of Agriculture has the authority to manage | No state plan; plan in development for Department of Defense lands | Game management, local damage control | DAWR issues removal permits for residents to reduce damage to property using a variety of measures | Unknown | Statewide |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Hawaii | Game especially within state-owned public hunting areas. Often treated as unregulated nuisance on private lands and invasive especially in designated natural areas, national parks and private preserves | Hawaii Revised Statutes (HRS) Chapter 183D Wildlife and Title 13 Hawaii Administrative Rules (HAR) Chapter 123 Regulating Game Mammals | No species-specific statewide management plan. There are game management plans for some islands that include feral swine. Some area plans that also mention feral swine | Objectives depends on purpose of the land | Yes, especially in the Natural Areas Preserve System | Unknown | On all main islands except Kahoolawe and Lanai. |
| Idaho | Invasive Species | Idaho Code 36-202(g):; Idaho Code General Laws Title 25. Animals Chapter 23; Idaho Code 22-1905. | No; established Feral Swine Working Group | Eradication | Yes | Unknown | Only in one localized area |
| Illinois | Damaging Invasive | In development | No, in development | Eradication; reduce impacts to native wildlife and wildlife habitat | Yes, Cooperative Program with APHIS Wildlife Services after acquiring | Two established populations; One area has been reduced to approximately | Established & self-sustaining populations known in two regions of Illinois; encompassing |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Illinois (cont.) | | | | | landowner permission to access land | 10 known individuals; the second is estimated to have > 100 individuals | parts of 5 counties, reports of sightings in 22 other counties |
| Indiana | Exotic mammal, invasive species, Swine | 312 IAC 9-3-18.6 IC 15-17-3-13; 345 IAC 1-3-13(e) | No | Develop or modify control techniques, provide technical assistance to landowners/ agency personnel, collect DNA for forensic application to illegal transport/ release, disease monitoring, protect public and domestic swine herds from diseases associated with feral swine | Yes, for some agencies involved | Unknown | Limited distribution, primarily 3-4 counties with smaller populations in 3-4 other counties, possible unknown populations |

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|---|---|---|---|---|---|---|---|
| Iowa | Non-game, invasive species | Iowa Senate File 564: An Act Regulating Dangerous Wild Animals | Yes | Local damage control and eradication | Not needed | Sporadic outbreaks | Only in a few counties |
| Kansas | Feral Livestock | KSA 47-1809 | No | Eradication | Yes, provides funds to APHIS Wildlife Services | 800 | Southern counties |
| Kentucky | No formal legal classification but considered invasive pest | KRS 150.186 and 301 KAR 3:030 | No, in progress | Eradication | Yes | Unknown | Statewide but locally isolated |

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|---|---|---|---|---|---|---|---|
| Louisiana | Outlaw Quadruped | LA RS 56:20, RS 3:2891 | No | LADWF: Public education on damage control, harvest strategies and personal protective procedures for disease. LDA: Population control, local damage control, information on diseases spread by feral swine | No. Feral swine harvested by state agency for disease surveillance only. | ~500,000 (LADWF estimate) | Statewide |
| Maine | Stray Livestock | Maine Revised Statute Title 7 §1341-1347; Department of Agriculture rules Chapter 206, 223 | No | Disease prevention and prevention of establishment of feral populations | Not needed | None | Not applicable |
| Maryland | Livestock, pets | None | No | Prevention | No | No known populations of feral swine | Not applicable |
| Massachu-setts | None | None | No, in development | Prevent Establishment or Eradication | No | None | Not applicable |

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|---|---|---|---|---|---|---|---|
| Michigan | Nuisance invasive species | Part 413 of Michigan's Natural Resource and Environmental Protection Act : 2010 Invasive Species Order, Animals Running at Large Act 328 of 1976, Section 433.14a | No, in development | Eradication | Yes, technical assistance only | Unknown | In a small number of counties |
| Minnesota | Eurasian wild pigs and hybrids thereof are a "restricted species" | Minnesota Statutes 17.457 - Restricted Species | No | None | No | None, isolated incidence of escaped domestic swine | Not applicable |
| Mississippi | Nuisance | 40 Mississippi Administrative Code Pt 2 Rule 7.1 | No | Eradication where possible, local damage control | No, planned | Unknown | Statewide, >38% of land area is occupied with wild hogs |
| Missouri | Non-game, invasive species | Missouri Revised Statutes: 270.260, 270.270 270.400 | Yes | Eradication | Yes | Estimated 10,000 to 15,000 | Isolated locations in southern third of state |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Montana | Illegal if Eurasian origin or hybrid thereof, no status if feral domestic | ARM 12.6.1541, ARM 12.6.1540 | Zero tolerance of any feral swine | Zero tolerance of feral swine, eradication of any known feral swine populations | No | <20 | Unknown if any |
| Nebraska | Nongame /Nuisance | Nebraska RS 37-524.01 | No | No tolerance eradication | No | None | Not applicable |
| Nevada | Stray livestock | NRS 569 | No | None | No | Unknown, sporadic outbreaks | Only a few counties |
| New Hampshire | No official status for feral swine but boar are defined as "Animals running at large" or escaped private property | "Running at large" RSA 467:3 | No | Eradication | Yes in cooperation with APHIS-WS as lead investigator | 100-250 | Verified in 4 counties but concentrated in western part of state |
| New Jersey | No official classification yet established | NJSA 23:4-63.3 | NJDFW, New Jersey Department. of Health (NJDH), and US Department of Agriculture developed | Eradication | APHIS Wildlife Services New Jersey (WS) and NJDFW cooperatively trapping Gloucester | <50 | Gloucester County only |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| New Jersey (cont.) | | | feral swine eradication plan involving the one feral swine population in Gloucester County, NJ. | | County population and occasionally set up bait and shoot. Deer hunters can take swine in this area and must report to NJDFW so that WS or NJDH can collect samples | | |
| New Mexico | No official designation | NM Statute 77-18-6 | Yes | Eradication | Yes | Unknown | Approximate-ly half of counties in state |
| New York<br><br>New York (cont.) | Not a domestic pig, invasive species | Environmental Conservation Law 11-0103, 11-0514, and 71-0925. | Currently using New York feral swine damage management environmental assessment and Feral Swine Management Protocol | Eradication | Yes, with APHIS Wildlife Services as the primary agent to implement goal | < 500 | Breeding population in 5 counties, feral swine noted in 21 other counties. |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| North Carolina | Wild animal/ nongame animal | 15A NCAC 10B .0101; 15A NCAC 10B .0223; 15A NACA 10B .0303; G.S. 106-798; G.S. 113-291.12 | No | No formal management objectives defined, desire is to slow or stop the spread in distribution of feral swine on the landscape and, where possible, reduce or eradicate populations that are already established. | No, with the exception of APHIS Wildlife Services on select properties and the NC Wildlife Resources Commission on one game land | Unknown | Several populations spread throughout the state. |
| North Dakota | Stray livestock or illegally released/escaped non-traditional livestock | North Dakota Century Code Title 36 Chapter 26 "Feral Swine" | No | Eradication | Yes | Unknown, sporadic outbreaks | Removed in a few counties and unverified reports statewide |
| Northern Marianas Islands | Game animal and feral animal | Title 85-30-1 Northern Marianas Administrative Code | No | Management, damage control | No | Unknown | Statewide, all inhabited islands. |
| Ohio | Game Quadruped | Ohio Division of Wildlife Definitions ORC 1531.01 (V) and Seasons for | Yes | Eradication | Yes, through APHIS Wildlife Services | Between 1000 and 5000 | Established breeding populations exist in the |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| | | game birds, game quadrupeds and furbearing animals. OAC 1501:31-15-17 (J) | | | | | southeast, unglaciated portion of the state, isolated emergent populations in the rest of the state |
| Oklahoma | Invasive | Feral Swine Control Act (Title 2, Chapter 1, Article 6 of OK Statutes) and Oklahoma Department of Agriculture Administrative Rules (Title 35, Chapter 15, Subchapter 34 of Oklahoma Administrative Code) | No | Local damage control | Yes | Unknown | Statewide |
| Oregon<br><br><br>Oregon (cont.) | Predatory Animal per Oregon Revised Statutes 610, feral swine are on the top 100 worse | OAR 635-058 OAR 635-058-0010 OAR 635-058-0020 ORS 603-010-0055 ORS 610.002 ORS 610.105 | Yes, The Feral Swine Action Plan for Oregon | Eradication | Yes, but limited | 2,000 - 5,000 | Primarily North Central Oregon (6 counties) and to a lesser extent |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| | invasive species list | | | | | | Southwest Oregon |
| Penn-sylvania | Inside fence: livestock/agriculture; Outside fence: invasive nuisance species | No formal regulations, new law regulations pending. | No | Eradication | No | Unknown Formal study contracted for one part of state | Sighted in at least 15 of ~80 counties, primarily NE Central and SW Central |
| Puerto Rico Puerto Rico | Exotic invasive species | Commonwealth regulation 6765, under Commonwealth act 241, Apendix A, list of invasive species | No | Control and if posibble eradication on main island and Mona Island. In Mona Island it is controled by sport hunting (game animal) | In mainland, is a recent event now under research. In Mona Island it is hunted as a game animal. | No estimates for mainland, but in ~154.4 ha of the municiplity of Aguas Buenas, from ~2003 to September 2013, nearly 250 wild pigs have been trapped by farmers. In Mona Island, Louson (1965) estimated 700 pigs, and DNER | Reported mostly within central municipalities: Aguas Buenas, Barranquitas, Comerío, Corozal and Naranjito. |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| (cont.) | | | | | | Biologist Gustavo Olivieri estimated 400-1300 pigs for Mona Island in 2012 | |
| Rhode Island | Unknown | Title 4 and 20 of RI General Laws | No | As there is currently no formal management plan there is no formal objective. Primary concern at this point is to prevent population from becoming established. | No | None | Does not occur |
| South Carolina | Unclassified | 50-16-25 Unlawful release of pigs | No | Control spread, local eradication, damage control | Generally no, but yes on certain WMA's. | 150,000 | Present in parts of all 46 counties. Densities vary dramatically. |
| South Dakota | Not defined | SD Administrative Rule 12:68:18:03.01 Specifically | No | None stated, but we have a zero tolerance policy. | Not at this time. | None, they do not occur here at this time. | None |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| South Dakota (cont.) | | prohibited nondomestic mammals. | | | | | |
| Tennessee | Species Deemed Destructive/ Nuisance | TCA 74 - 107, TCA 74 - 133, TN Fish and Wildlife Commission Proclamation 13-09 | In progress | Eradication | Yes | estimated at 130,000 | 60 % of the state |
| Texas ***** | Exotic Livestock | Texas Health and Safety Code Title 10 § 825.001, Texas parks and Wildlife Code Title 5 § 42.002, Texas Administrative Code Title 4 § 55.9 | Only Texas AgriLife Extension has a written management strategy | No universal objective. Objectives vary among agencies depending upon authority | Yes. State removes approximately 20,000 feral swine per year for damage management | 1.8-3.4 million swine (average 2.6 million) | Statewide; all counties except one have documented feral swine, However, there is no known reproduction in about 10 counties. |
| Utah | Stray Livestock, invasive species | 4-25-12.1. Release of swine for hunting purposes. | No | Prevention and eradication | No | Unknown | Only in a few counties |
| Vermont | Invasive species | 4709 importation, stocking wild animals, possession of wild Boar | No | Eradication | No, planning | Unknown | Unknown |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Virginia | Livestock, Nuisance species, pest, agricultural animal, animal, non-commercial swine, domestic animal. | Code 3.2-700, 5400 and 6500; 29.1-100, 511, 520B, 521A1, 521A4 and 530; Regulations 2VACS(5?)-141-10; 2VAC5-141-120; 4VAC15-20-50; 4VAC15-20-160 | No | Eradication, local damage control | No, planned | 5,000 widely distributed in small disjunct populations. | Statewide in small disjunct populations. |
| Virgin Islands | Stray livestock | N/A | No | Erosion control; T&E protection; Crop protection | NO | Sporadic outbreaks | In small pockets |
| Washington | Invasive Species | None | No | Eradication | No | No Known Breeding Population | No Known Population |
| West Virginia | Wild boar considered game animals with an established firearms and archery hunting season. Feral swine considered nuisance animals. | Title 61 Legislative Rule - Department of Agriculture - Series 1 - Animal Disease Control: Section 61-1-7.16 refers to Swine; and WV State Law - Chapter 19, Agriculture - Article 18: General Stock Law | No, in development | Allow for hunting seasons within the wild boar management area based on population fluctuations and resident hunter demand. Protect the genetic strain of wild boar within the | Yes for DNR, in cooperation with APHIS Wildlife Services but not for WDA | Unknown, with sporadic outbreaks in southern areas of state | 40 to 50 percent of counties have reported feral swine sightings since records have been recorded |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| West Virginia (cont.) | | | | wild boar management area from being contaminated by feral swine populations. Provide hunting opportunities within the wild boar management area for 1,500 wild board hunters. All other feral swine populations should be eliminate, if possible. WDA - test and eradication, damage control | | | |
| Wisconsin | Invasive species and a Harmful Wild Animal | WI DNR, NR Chapters 10,12,16, and 40 address feral swine | No | Eradication | Very little | < 50 | Breeding population known in one county. |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Wyoming | Neither Wyomin g Title 23 (Game and Fish) Statutes or Wyoming Game and Fish Commission (WGFC) Regulations have a definition of "Feral Swine", but there are definitions of "wildlife", "wild", "and domestic animals" that relate to the legal classification/stat us of feral swine. WGFC Chapter 10 Regulation for the Importation, Possession, Confinement, Transportation Sale and | W.S 11-48-101 and 102 Feral; W.S. 23-1-302 and WGFC Chapter 10 Regulation for the Importation, Possession, Confinement, Trans portation Sale and Disposition of Live Wildlife | No | WGFD does not have written state management objectives, intent and desire to prevent feral hogs from becoming established in Wyoming and address any feral hog that are found in the state in an appropriate, aggressive and timely fashion. | No | None | Not applicable |

| State/ U.S. Territory | Designated legal classification/ status of feral swine | Primary statute/regulations for feral swine | Is there a written management plan for feral swine? | State management objectives | Is State engaged in an active feral swine damage control program? | Current agency(ies) statewide feral swine population estimate | Distribution of feral swine |
|---|---|---|---|---|---|---|---|
| Wyoming (cont.) | Disposition of Live Wildlife prohibits the importation or possession of all members of the family Suidae, expect domestic swine and pot-bellied pigs, in Wyoming. The WDA statutes do not list feral swine as a predator species in Wyoming. | | | | | | |

**Table 3:** Information on Hunting for Feral Swine by State/Territory

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Alabama | Yes | Hunting license required to hunt, but not if causing damage outside of hunting season | Yes if hogs are present, preserve cannot bring them in to hunt | Yes |
| Alaska | Yes | Land status restrictions, no hunting in a city, on private property or in National Park | Yes | No, they cannot be free-ranging; must be confined |
| American Samoa | (NR) | (NR) | (NR) | (NR) |
| Arizona | No | No | Yes, but only one in state which recently had its permit expire | Yes |
| Arkansas | Yes | Hunting license required | Yes | Yes |
| California | Yes | Hunting license required unless a depredation permit is provided or landowner or agent encounters pig doing damage | Yes | Yes |
| Colorado | Yes | No | One grandfathered | No |
| Connecticut | No | No | No | No |
| Delaware | No | Permit from Division required | No | No |
| Florida | Yes | No restrictions on private lands | Yes | Yes |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Georgia | Yes | On private lands: Hunting license required, may be hunted year round, no limit, night hunting allowed, light allowed, bait allowed. No hunting from a vehicle, except by permit. On public lands: restrictions vary by location, more restrictive than on private lands. | Yes | Yes |
| Guam | Yes | Hunting license or a revocable removal permit required | Yes, but do not exist in state | Yes, not aware of any existing |
| Hawaii | Yes | Hunting license required for public lands. No restrictions if causing damage, however, if a permit is requested, one may be issued. | Yes | Yes |
| Idaho | Yes | Hunting license required | Yes | No |
| Illinois | Yes | No, not at this time | Yes | Yes |
| Indiana | Yes | No, but hunting only with landowner permission. | No | No |
| Iowa | Yes | No | Yes | No |
| Kansas | No | No sport hunting | No | No |
| Kentucky | Yes | Hunting license required; daylight hours hunting only | Yes | Yes |
| Louisiana | Yes | Basic hunting license required to shoot or live trap. Trapping license required to snare. | Yes | Yes |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Maine | No | Yes | Yes by permit and capped number | Yes, only permitted fenced areas |
| Maryland | No | No, but there are potential hurdles in local animal cruelty laws | No | No |
| Massachusetts | No | Yes | No | No |
| Michigan | Yes | Must have hunting license on public land, must have landowner permission on private land | Yes, however, not allowed to have certain phenotypes of swine | No |
| Minnesota | No | Eurasian wild boars, their hybrids, and domestic swine at large are not protected and may be shot however, feral swine are not considered a game species therefore there is no hunting season. | No, although two facilities were grandfathered in before the ban on feral swine hunting preserves was put in place. One of these sites allows hunting and the other raises swine for meat production | No |
| Mississippi | Yes | License for hunting on private land/public lands beyond being the titled landowner | No | Yes |
| Missouri | Yes | Yes, but only during firearm deer and turkey seasons | Yes | Yes |
| Montana | Yes | No | No | No |
| Nebraska | No | Yes | No | No |
| Nevada | No | Yes | No | No |
| New Hampshire | Yes | Current regular NH hunting license required. Feral swine are considered escaped private property and may only be hunted with permission of the property owner per New Hampshire RSA 467. | Yes | Yes |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| New Jersey | Yes | Hunting of feral swine allowed during deer seasons in areas identified as having hogs. Hunters would need permission to be on private land. Special wildlife management permit issued to local golf course by the NJ Div. of Fish and Wildlife for take outside of deer seasons. | No, hunting preserves cannot have hogs. | No, population so small this is not an issue. |
| New Mexico | Yes | No | No, not for feral swine | No |
| New York | Yes | Yes, as of October 1, 2013, only landowners allowed to shoot feral swine | Yes, but hunting preserves have until August 31, 2015 to remove all swine from inventory. | Yes, until August 31, 2015 |
| North Carolina | Yes | Hunting license required for hunting. No license required for swine causing damage | No | Yes, as long as the feral swine were not stocked and are not fenced |
| North Dakota | No | Yes | North Dakota does not define "Hunting Preserves". Individuals who have captive, privately owned swine and meet the requirements in North Dakota Administrative Code 48-12-02.1-01 may operate freely. | No |
| Northern Marianas Islands | Yes | Weapon restrictions only | No | Yes; private land access can be sold, but authority to hunt is exclusively regulated by Division of Fish and Wildlife |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Ohio | Yes | No closed season, no bag limit, no license required if hunting or trapping on own property, otherwise, license required | Yes | Yes |
| Oklahoma | Yes | Hunting license not required on private lands. License required on public lands. If hunting occurs during a current game animal hunting season, a tag for that appropriate game animal is required. Night hunting and aerial hunting requires permit. | Yes | Yes |
| Oregon | Yes | Feral swine not a game animal, defined as "predatory" animals and nothing in the state law prohibits a landowner or their agent from eradicating them. No hunting licenses are required, state law requires landowners aware of the presence of feral swine on their land to develop a plan to eliminate them. | No | No |
| Pennsylvania | Yes | Hunting license required to remove free-ranging swine. Hunter must be engaged in some other type of hunting. Hunter take must be reported. Spearing is allowed. | Yes | Yes |
| Puerto Rico | Yes, Mona Island only | Farmer can legally euthanize the animal if there is no owner and is causing damages. | Yes, only in Mona Island. Could be considered in the near future for mainland. | No |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Rhode Island | No | Unknown | No | No |
| South Carolina | Yes | Hunting license required if hunting, some restrictions on night time activities | Yes | Yes |
| South Dakota | No | No | No | No |
| Tennessee | No | Yes | Yes, but no new preserves allowed | Yes |
| Texas | Yes | Hunting license required to shoot feral swine, but landowner or agent may shoot unlimited swine if they are doing damage | Yes | Yes |
| Utah | No | No, releasing them for hunting purposes is illegal | No | No |
| Vermont | No (undefined) | No (undefined) | None permitted at this time. | No |
| Virginia | Yes | No, unless someone claims them | No | Yes for free-ranging, but not for enclosures. |
| Virgin Islands | No | Yes | No | No |
| Washington | Yes | No | Yes | No |
| West Virginia | Yes | No, but there are no established hunting seasons for feral swine | Yes | Yes |
| Wisconsin | Yes | Hunting license required when hunting on public land or land the hunter does not own. Property owners are exempt from license requirement while hunting on land they own. | No | Yes, as long as they are not within a fence |

| State | Is Feral Swine Hunting Allowed? | Are there Restrictions on Killing Feral Swine? | Are Hunting Preserves Allowed? | Is Sale of Hunting Opportunities for Free-Ranging Swine on Private Land Allowed? |
|---|---|---|---|---|
| Wyoming | No | No authorized hunting seasons for feral swine. Wyoming restrictions would be for swine being declared feral (11-48-101 and 11-48-102) or illegally imported/possessed and the statutory/regulatory process to lethally remove them. No Wyoming laws preventing the general public from killing feral swine. | No | No |

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# APPENDIX E

# THREATENED AND ENDANGERED SPECIES IMPACT ASSESSMENT TOOL

This Appendix provides tables summarizing potential risks to federally-listed candidate, proposed, threatened, endangered species from the proposed FSDM activities. The table also provides examples of SOPs and mitigation measures which may be implemented to reduce or eliminate risks. The table is intended as a blueprint to aid APHIS-WS State, Territory and Tribal level consultations and conferences with the FWS on risks to federally-listed species.

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Technical assistance | Alternatives 1, 2, 3 and 4 | No Effect | None | None | | |
| National level outreach expanded, including public education and information/ assistance with State/Territorial/ Tribal regulatory mechanisms. | Alternatives 2, and 4 | No Effect | None | None | | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Frightening devices | Pyrotechnics, other sounds, strobe lights, other visual deterrents<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | Disturbance | Terrestrial vertebrates | Auditory and visual devices to frighten feral swine are likely to also disperse non-targets, including T&E species. However, potential impacts are expected to be temporary with both target and non-target species returning after cessation of dispersal methods.<br><br>Feral swine become quickly habituated to the use of frightening devices. Thus, the use of such devices would likely be minimal due to their limited effectiveness.<br><br>Devices would primarily be deployed at airports and to protect agriculture crops/livestock during periods when crops or livestock are particularly vulnerable. These areas are not generally the types of habitats commonly used by T&E species.<br><br>Method use may be avoided | Site specific determinations would be made to determine effect. These methods are not likely to adversely affect T&E species with avoidance (i.e., not using the method in places where the T&E species occurs) or other practices and may have no effect.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for this method as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | where T&E species may be found, or methods may be avoided during seasons when species are vulnerable to disturbance. | |
| Monitoring to locate/track swine | Judas pig<br><br>Alternatives 1, 2, 3, 4 and 5 | Telemetry collar: No Effect | None | None | | |
| | | Capture: effect depends on trap method used | See discussions on trapping methods. | | | |
| | Aerial location of swine<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | 1) Disturbance from aircraft<br><br>2) Disturbance and trampling by ground crews | Terrestrial vertebrates and plants | Flight passes are brief and not of sufficient duration or frequency to constitute a chronic disturbance (see attached text on aerial shooting).<br><br>Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners | With avoidance and other practices, this method would have either no effect or would not be likely to adversely affect terrestrial birds and mammals.<br><br>Section 7 consultations are either in place locally |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | identifies areas where listed species may be affected. Sensitive areas can be avoided or pilots watch for individuals and avoid. For example in Nevada, sage grouse leks are avoided as specified in work plans coordinated with BLM. In some areas it may be possible to adjust time of flight (season or time of day) and distance from sensitive areas (e.g., sage grouse leks) to avoid disturbance of breeding birds.<br><br>Effects of ground crews are addressed in section on vehicular site access below. | and/or would be completed or updated for this method as applicable. |
| | Tracking dogs<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | Disturbance | Terrestrial vertebrates | APHIS-WS would not release dogs in areas where they may disturb listed species (e.g. tracking dogs may not be used in occupied habitat of the southwest willow flycatcher during nesting season). | Adverse effects are not likely or no effect.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | In accordance with APHIS-WS policy (APHIS-WS Directive 2.445), all dogs used by APHIS-WS employees must be trained in the skills necessary to perform a specific WDM task and be controllable at all times.<br><br>Coordination with FWS, State/ Territorial/Tribal natural resource management agencies, land management agencies and/or landowners identifies areas where listed species may be affected. | this method as applicable. |
| Monitoring for diseases in feral swine | Capture (depends on method used)<br><br>Alternatives 1, 2, 3, 4 and 5 | See effects below | See discussion under individual capture methods. | | | |
| | Sample collection | No Effect | None | None | | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Alternatives 1, 2, 3, 4 and 5 | | | | | |
| GonaCon/ reproduction inhibitors | Currently only formulated for use as injection.<br><br>Formulation for oral ingestion<br><br>under development and not currently proposed for operational use. | No Effect | None | None | Available toxicity data for GnRH suggests the active ingredient is practically non-toxic to mammals. This is reflected in the lowest toxicity (Category IV) for acute oral, dermal, inhalation, and ocular exposure routes determined by USEPA/Office of Pesticide Programs (OPP).<br><br>There is no known danger associated to humans or wildlife from eating animals that have been vaccinated with GonaCon™. In 2009, the EPA determined there is little likelihood of dietary exposure or impacts to humans who consume meat from a treated doe. As with other vaccines, such as those used with livestock, both | EPA registration of GonaCon would likely include ESA Section 7 consultation prior to approval. Associated endangered species considerations and use restriction would be included on the product label or in EPA's Bulletins Live system. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | the vaccine and the antibodies produced are proteins. Once ingested, they are broken down by stomach acids and enzymes. Similar injectable hormone-altering products are used routinely in livestock applications. | |
| Killing methods | Sodium nitrite<br><br>Under development.Not currently proposed for use. | May affect | 1) Poisoning non-targets that can ingest treated bait and animals that ingest treated species.<br><br>2) Trampling | 1) All terrestrial vertebrate species<br><br>2) Plants in vicinity of feeder | 1) Toxicity of nitrite to nontarget organisms such as mammals and birds is moderate to high based on acute oral dosing studies. Exposure and risk to terrestrial non-target organisms is greatest for those animals that have access to and are likely to eat the bait material. Risks to non-target species can be reduced through bait formulation, selection delivery system (feeder type), bait placement, and avoiding use during periods when vulnerable | EPA registration for sodium nitrite would likely include ESA Section 7 consultation prior to approval. Associated endangered species considerations and use restriction would be included on the product label or in EPA's Bulletins Live system. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | migratory species may be present.<br><br>Product would not be applied in a manner or location which would permit runoff from bait sites into water. Consequently we anticipate no risk to aquatic organisms.<br><br>2) Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected. Bait stations would not be placed in areas where they could adversely affect T&E species habitat. | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Aerial shooting<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | 1) Disturbance from aircraft<br><br>2) Lead poisoning<br><br>3) Disturbance and trampling by ground crews | 1) Terrestrial mammals, birds<br><br>2) Scavengers , birds | 1) Flight passes are infrequent and temporary but may be more concentrated in some areas than surveillance. (i.e., additional passes may be made to dispatch whole sounder). Exposure is not chronic – see attached text on aerial shooting.<br><br>1, 2, 3) Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected. Areas can be avoided or pilots watch for individuals and avoid (e.g., in Nevada, sage grouse leks are avoided as specified in work plans coordinated with BLM).<br><br>2) Carcass retrieval is generally cost prohibitive but may be possible in limited circumstances. Carcasses have to be recovered by ground crews. In some areas, removal by ground crews may also not be feasible or environmentally desirable, especially in remote locations with few roads, or in sensitive habitats such as desert ecosystems with fragile soils and vegetative cover. | Avoidance would result in no or unlikely effect.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for this method as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Snares<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | Non-target capture | Large mammals and birds | APHIS-WS primarily uses blind sets for snares or sets snares on routes to bait sites. Baits are typically grain-based and meat baits are not used. Prior to setting snares, APHIS-WS specialists examine travel way to determine if non-target species are using the trail and avoid setting snares on travel routes where there is evidence of extensive use by non-target species. Space is left between snare sets so that animals scavenging on the carcass of a pig caught in one snare would not be at risk of capture from an adjacent snare.<br><br>Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected.<br><br>Other potential protective measures which may be | Use of snares can result in risk of take for some species.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for this method as applicable to ensure that this method does not jeopardize listed species. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | implemented on a case-by-case basis may include not using snares in habitat occupied by the species of concern or not using snares during times of year when the T&E species of concern is active (e.g., snares might be used during season when non-target species are hibernating or have migrated out of project area). Snare stops and breakaway snares may also be used to reduce risks of adverse impacts on T&E species. Snares may be checked more frequently than State/Territorial/Tribal law requirements to reduce risk of adversely impacting a T&E species if it is inadvertently captured in a snare. | |
| | Foothold traps<br><br>Alternatives 1, | May affect | Non-target capture | Large mammals and large birds | Foothold traps are not a preferred method for capturing feral swine. APHIS-WS primarily uses blind sets for foothold traps or sets traps on routes to bait sites. Baits are typically grain-based and meat | Use of foothold traps can result in risk of take for some species. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | 2, 3, 4 and 5 | | | | baits are not used. Prior to setting traps, APHIS-WS specialists examine travel way to determine if non-target species are using the trail and usually avoids setting traps on travel routes where there is evidence of extensive use by non-target species. Space is left between trap sets so that animals scavenging on the carcass of a pig caught in one trap would not be at risk of capture from an adjacent trap. Pan tension devices are used to prevent smaller animals from triggering the traps.<br><br>Other potential protective measures which may be implemented on a case-by-case basis may include not using traps in habitat occupied by the species of concern or not using snares during times of year when the T&E species of concern is active (e.g., snares might be used during | Section 7 consultations are either in place locally and/or would be completed or updated for this method as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | season when non-target species are hibernating or have migrated out of project area). .Foothold traps may be checked more frequently than State/Territorial/Tribal law requirements to reduce risk of adversely impacting a T&E species if it is inadvertently captured in a trap. | |
| | Ground shooting<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | Lead poisoning | Scavengers, birds and mammals | In some areas, APHIS-WS may avoid using lead shot and bullets where carcasses may be scavenged. Nontoxic ammunition options suitable for feral swine are currently limited based on cost and availability.<br><br>Carcasses shot with lead may be retrieved or made inaccessible to scavenging birds (e.g. California condor). | Take may occur if avoidance of lead ammunition or carcass removal/burial is not possible.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for this method as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Capture methods | Cage traps/corral (including use of bait and fencing to surround trap area, if used)<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | 1) Non-target capture<br><br>2) Trampling<br><br>3) Critical habitat destruction of Primary Constituent Elements (PCEs) | 1) Large mammals<br><br>2) Terrestrial plants<br><br>3) Critical habitat of any species | 1) When possible, baits are used that do not attract listed species. Camera devices may be used to monitor and trigger traps when pigs enter traps. Traps are checked frequently according to State/Territorial/Tribal law and APHIS-WS policy. Corral traps have open tops and usually have large mesh wire allowing escape for many species. Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected.<br><br>2, 3) Where possible, cage and corral traps are set in previously disturbed or cultivated areas. Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected. | 1) Use of target specific baits would avoid effects on carnivores. Camera systems and remotely activated traps would allow for capture avoidance.<br><br>2, 3) Coordination with land and resource managers is likely to allow management actions that would result in no effect on listed plants and critical habitats.<br><br>Determinations of effects on large mammals, terrestrial plants, and critical habitat would be made locally based on species presence, proposed work locations, and coordination with land management |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | Potential effects can be avoided by not locating cage and corral traps where listed plant species and critical habitat elements may be adversely affected. This would consider both trap setup/construction/placement and attracting feral swine to area. | agencies.<br><br>In most instances, use of this method is likely to have no effect or may affect but is unlikely to adversely affect.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for these methods as applicable. |
| | Drop nets<br><br>Alternatives 2, 3, 4 and 5 | May affect | 1) Non-target capture<br><br>2) Trampling<br><br>3) Critical habitat destruction of | 1) Large mammals<br><br>2) Terrestrial plants<br><br>3) Critical | 1) Use of drop nets requires constant supervision by APHIS-WS personnel. Nets are deployed manually by personnel only when target species are present. Nets would not be deployed if non-target species, including T&E | 1) Effects are not likely or no effect.<br><br>2, 3) Coordination with land managers and avoidance of sensitive areas is likely to result in |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | Primary Constituent Elements (PCEs) | habitat of any species | species, are present within the capture zone.<br><br>2, 3) The potential effects of trampling can be avoided by choosing drop net sites where no listed plant species or critical habitat elements are present or where no listed plant species or critical habitat could be adversely affected. This would include taking into account the specific drop net location as well as the surrounding area where swine may be attracted. | no effect on listed plant species or critical habitats. |
| Exclosures | Fencing or other barriers<br><br>Alternatives 2, 3, 4 and 5 | May affect | 1) Trampling<br><br>2) Critical habitat destruction of PCEs<br><br>3) Affect migration of non-target wildlife or exclude them from area. | 1) Terrestrial plants<br><br>2) Critical habitat of any species<br><br>3) Migratory terrestrial | APHIS-WS is not likely to install exclosures. APHIS-WS may provide technical assistance to landowners for this method, however the fencing would be installed by the resource manager or landowner, who would be responsible for ESA compliance. In the unlikely event that APHIS-WS would install exclosures, APHIS-WS would initiate local | Section 7 consultations would be initiated as appropriate. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | consultation as appropriate. | |
| Carcass disposal | Landfill<br><br>Alternatives 1, 2, 3, 4 and 5 | No Effect | None | None | Licensed landfills have regulations and monitoring in place to prevent adverse impacts on T&E species. | |
| | Leave in place<br><br>Alternatives 1, 2, 3 4 and 5 | May affect | 1) Attract scavengers that cause disturbance or predation.<br><br>2) Lead poisoning | 1) Ground nesting birds<br><br>2) Scavengers | 1)Carcasses may be retrieved from nesting areas with ground nesting birds or removals may be scheduled to avoid seasons when ground-nesting birds and their offspring are vulnerable to scavengers that may be attracted by carcasses.<br><br>Coordination with land management agencies would identify areas of concern for | Coordination with managers is likely to result in no effect.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for these methods as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | avoidance.<br><br>2)See shooting | |
| | Onsite burial<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | 1) Disturbance from digging<br><br>2) Soil erosion and runoff<br><br>3) Critical habitat | 1) Terrestrial species<br><br>2) Aquatic species<br><br>3) Alteration or loss of primary constituent elements (PCEs) | 1, 3) Burial sites large enough to accommodate several swine would likely be located on pre-disturbed sites such as agricultural operations. Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected.<br><br>APHIS-WS personnel are, or would be trained in the identification of T&E species and would avoid burial of individual | Site selectivity would result in no effect. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | animals if listed species that may be affected by digging disturbance were observed either on site or in the surrounding area.<br><br>2) APHIS-WS would follow State/Territorial/Tribal and local regulations and guidelines pertaining to the incidental burial of animals. State/Territorial/Tribal guidelines generally offer recommendations for general soil types, burial depth, and distance from ground water to prevent leachates from entering surface or ground water. | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determina tion | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Composting<br><br>Alternatives 2, 3, 4, and 5 | May affect | 1) Trampling<br><br>2) Runoff/water contamination<br><br>2) Critical habitat | 1) Terrestrial plants<br><br>2) Aquatic species<br><br>2) Alteration or loss of primary constituent elements (PCEs) | 1, 3) Pre-disturbed or cultivated areas, such as agricultural operations, would be preferred for composting site locations. When and where possible, APHIS-WS could use established compost systems. If a new site must be established coordination with FWS, State /Territorial/Tribal resource agencies, land management agencies and/or landowners would identify areas where listed species or critical habitats may be affected to ensure those areas could be avoided.<br><br>2) APHIS-WS would follow State/Territorial/Tribal and local regulations and guidelines pertaining to the incidental burial of animals. State/Territorial/Tribal guidelines generally offer recommendations for general soil types, burial depth, and distance from ground water to prevent leachates from | Site selectivity would result in no effect. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | entering surface or ground water. | |
| | Donation for human or animal consumption<br><br>Alternatives 1, 2, 3, 4 and 5 | No Effect | None | None | | |
| | Rendering<br><br>Alternatives 2, 3, 4 and 5 | No Effect | None | None | Regulations governing the operation of rendering facilities would prevent adverse impacts on T&E species. | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Incineration (Fixed facility)<br><br>Alternatives 2, 3, 4 and 5 | May Effect | 1) Air quality | 1) Terrestrial species<br><br>2) Aquatic species | 1,2) APHIS-WS would likely not employ open-air burning or air curtains as methods for carcass disposal. Any incineration would be through the use of fixed-facility incinerators which are highly controlled. Most incinerators are fitted with afterburners to reduce emissions (Walawender 2003). Ash produced in fixed-facility incinerators is typically considered safe and can be disposed of in landfills (Ahlvers 2003) resulting in no effect. | No Effect. |
| | Chemical digester<br><br>Alternatives 2, 3, 4 and 5 | No Effect | None | None | Regulations governing the operation of chemical digesters would prevent adverse impacts on T&E species. | |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| General | All activities reducing the number of swine occurring in the vicinity of listed carnivores/scavengers<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | Loss of prey | Florida panther | Florida panther occurs in areas high population of feral swine and are known to prey on feral swine. Logistical constraints and State and Tribal policy indicate that elimination or substantial reduction in feral swine population within the range of this species is unlikely. Management efforts in the state will primarily consist of localized damage management to protect specific resources or human safety. Coordination with FWS and State will prevent adverse impacts on swine population in areas were Florida panther may be adversely impacted. | May affect, not likely to adversely affect due to coordination with state and federal agencies.<br><br>Section 7 consultations are either in place locally and/or would be completed or updated for these methods as applicable. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Foot/ horseback access for all activities<br><br>Alternatives 1, 2, 3, 4 and 5 | May affect | 1) Adverse modification of critical habitat, destruction of Primary Constituent Elements.<br><br>2) Trampling | 1) Species with proposed or designated CH.<br><br>2) All terrestrial plants | 1) Coordination with FWS and other resource management agencies would identify areas where critical habitat may be affected.<br><br>2) Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed plant species may be affected.<br><br>Where access to areas with listed plant communities is proposed, special precautions such as plant identification and avoidance may be implemented. | 1)Effect not likely under typical operations. Local determinations would be made based on habitat types, designations, work locations, and proposed operations. Consultations would be initiated if proposed actions may affect critical habitat or listed plants.<br><br>2) Local Section 7 consultations would be initiated if proposed actions may occur in areas where listed terrestrial plants are found. |
| | Vehicular access for all activities | May affect | 1) Disturbance<br><br>2)Trampling/crush | 1) Terrestrial vertebrates, nesting birds<br><br>(especially | Vehicles primarily use existing roadways. | Effect not likely under typical operations. Local determinations would be made based on habitat types, designations, work |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Alternatives 1, 2, 3, 4 and 5 | | ing | desert tortoise, ground nesting birds, plants) | Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected. Nesting areas may be avoided during breeding season.<br><br>Vehicles in desert tortoise habitat drive at certain speeds which allow careful observation for desert tortoise in roadway.<br><br>Parked vehicles in desert tortoise habitat are checked for tortoises during their active season.<br><br>Some work may occur in desert tortoise habitat only during the hibernation period.<br><br>Ground crews assisting aerial shooting teams generally only use established roads and trails, which minimizes risk of disturbing birds or mammals or crushing listed | locations, and proposed operations. Consultations would be initiated if proposed actions may affect listed species or critical habitat. |

| APHIS-WS Actions | Sub Actions (if any) and Alternatives | Effect Determination | Type of effect(s) | Species type affected | Typical program practices (SOPs and other minimization measures that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | | | | | plants and animals. Off-road movements are most likely to occur in situations where ground crews are retrieving carcasses of animals | |

# APPENDIX F

# MIGRATORY BIRD AND EAGLE IMPACT ASSESSMENT TOOL

This Appendix provides tables summarizing potential risks to birds protected under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act. This table is intended as a blueprint to aid APHIS-WS State, Territory and Tribal level analysis of impacts to migratory birds and eagles.

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Technical assistance | Alternatives 1,2,3,and 4 | None | None | None | | |
| Cooperative agreements | Alternatives 1,2,3,and 4 | None | None | None | | |
| National level outreach expanded, incl. public education and information/assistance with State/Territorial/Tribal regulatory mechanisms. | Alternatives 2 and 4 | None | None | None | | |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Cost sharing | Cost sharing involving APHIS absorbing the costs in a cooperatively funded program. Alternatives 1, 2,3, and 4 | | | | | |
| | Grants. Transfer of funding to other agencies or institutions for research (1) or operations (2). Alternative 5 | Low potential for take | 1) Research impacts cannot be predicted at this time and will have to be addresses through situation-specific consultations.<br>2) Impacts are expected to be similar to those identified below for operational use of methods. | 1) Migratory birds<br>2) Eagles | 1) Research may be conducted in confinement or laboratory environments.<br>2) Operational activities conducted with grants from APHIS will comply with the MBTA and BGEPA | Grants would require review of potential for take at the local or project specific level. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Frightening Devices | Pyrotechnics, other sounds, strobe lights, other visual deterrents.<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Noise<br>2) Avoidance<br>3) Human disturbance | 1) Migratory Birds<br>2) Eagles | Auditory and visual devices to frighten feral swine are likely to also disperse non-targets, including eagles and migratory birds, in the area. However, potential impacts from noise and human disturbance are expected to be temporary with non-target species returning after cessation of dispersal methods. Dispersal methods would not be employed with sufficient frequency and duration that essential resources (e.g. food, habitat) would be unavailable for extended durations.<br>Feral swine become quickly habituated to the use of frightening devices. Thus, the use of such devices would likely be minimal due to their limited effectiveness.<br>Devices would primarily be deployed at airports and to protect agriculture crops/livestock during periods when crops or livestock are particularly vulnerable.<br>Method use may be avoided where active eagle nests are located, or methods may be avoided during breeding seasons when migratory birds are vulnerable to disturbance. | 1) No take of migratory birds would be expected with implementation of SOPs.<br>2) No take of eagles expected since take would be avoided with implementation of SOPs (SOPs should include the eagle nest avoidance distance in FWS (2007)). |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Monitoring to locate/track swine | Judas pig<br><br>Alternatives 1, 2, 3, 4, and 5 | Telemetry collar: None | None | None | | |
| | | Capture: effect depends on trap method used | See discussion below | | | |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Aerial location of swine<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Human disturbance<br>2) Noise<br>3) Collisions | 1) Migratory birds during breeding season<br>2) Eagles | Flight passes are brief and not of sufficient duration or frequency to constitute a chronic disturbance.<br><br>Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where nesting eagles may be affected. Sensitive areas can be avoided or pilots watch for individuals and avoid. In some areas it may be possible to adjust time of flight (season or time of day) and distance from sensitive areas to avoid disturbance of breeding birds.<br><br>Effects of ground crews are addressed in section on vehicular site access below.<br><br>With avoidance, minimizing the time in the area, and other practices, this method would not result in take of of migratory birds or eagles. | No take of migratory birds or eagles is expected based on infrequent overflights and implementation of SOPs. Eagle nests would be identified and avoided. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Tracking dogs<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take. | 1) Disturbance<br>2) Noise | 3) 1) Migratory birds (especially ground nesters)<br>4) 2) Eagles | APHIS would not release dogs in areas where they may disturb listed vulnerable species (e.g. tracking dogs may not be used in occupied habitat of the southwest willow flycatcher during nesting season).<br><br>In accordance with APHIS policy (APHIS-WS Directive 2.445), all dogs used by APHIS employees must be trained in the skills necessary to perform a specific wildlife damage management task and be controllable at all times.<br><br>Coordination with FWS, State/ Territorial/Tribal natural resource management agencies, land management agencies and/or landowners identifies areas where listed migratory bird species and eagles may be affected.<br><br>Method use may be avoided where active eagle nests are located, or methods may be avoided during breeding seasons when migratory birds are vulnerable to disturbance. Time can be minimized in an area to further reduce impacts to eagles and migratory birds. | With implementation of SOPs, no take of migratory birds or eagles is expected. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Monitoring for diseases in feral swine | Capture (depends on method used)<br><br>Alternatives 1, 2, 3, 4, and 5 | See effects below | See discussion below | | | |
| | Sample collection<br><br>Alternatives 1, 2, 3, 4, and 5 | None | None | None | | |
| GonaCon™/ reproductive inhibitors | Injection | None | None | None | There is no known danger to humans or wildlife from eating animals that have been vaccinated with GonaCon™. In 2009, the EPA determined there is little likelihood of dietary exposure or impacts to humans who consume meat from a treated doe. As with other vaccines, such as those used with livestock, both the vaccine and the antibodies produced are proteins. Once ingested, they are broken down by stomach acids and enzymes. Similar injectable hormone-altering products are used routinely in livestock applications. | ? |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Lethal method | Aerial shooting<br><br>Alternatives 1, 2, 3, 4, and 5 | High potential for take | 1) Disturbance from aircraft<br>2) Lead shot poisoning (steel or other not a problem)<br>3) Human disturbance<br>4) Collisions | 1) Migratory birds and eagles during breeding season<br>2) Scavengers/ birds of prey<br>3) Eagles<br>4) Any bird during flight. | 1,3)Flight passes are infrequent and temporary but may be more concentrated in some areas than surveillance (i.e., additional passes may be made to dispatch whole sounder). Exposure is not chronic.<br><br>1, 2, 3, 4)Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners to identify areas where migratory birds and eagles may be affected. Areas can be avoided or pilots watch for individuals and avoid.<br><br>2) Carcass retrieval is generally cost prohibitive but may be possible in limited circumstances. Carcasses have to be recovered by ground crews. In some areas, it may also not be feasible or environmentally desirable, especially in remote locations with few roads, or in sensitive habitats such as desert ecosystems with fragile soils and vegetative cover.<br><br>2) Some APHIS state programs use all or primarily non-toxic shot from aircraft. [PENDING input from | Pending risk analysis Take from lead poisoning remains likely where carcasses shot with lead are left in the field and scavenged by migratory birds or eagles.<br><br>No take is expected from other factors due to infrequent overflights, avoidance based on coordination with land owners/managers, and pilot and ground crew training.<br><br>The potential for bird strikes remains, as with any aircraft use. Should we try to figure out if there have been any strikes reported from WS aircraft use?) |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Snares<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Non-target capture<br>2) Human disturbance | 1) Eagles, raptors and owls<br>2) Eagles | 1)APHIS primarily uses blind sets for snares or sets snares on routes to bait sites. Baits are typically grain-based, and meat baits are not used. Prior to setting snares, APHIS specialists examine the trail to determine if non-target species are using the trail and avoid setting snares on travel routes where there is evidence of extensive use by non-target species. Space is left between snare sets so that animals scavenging on the carcass of a pig caught in one snare would not be at risk of capture from an adjacent snare.<br><br>1, 2) Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where eagles, raptors, or owls may be affected.<br><br>1, 2)Other potential protective measures which may be implemented on a case-by-case basis may include not using snares in habitat occupied by eagles, raptors, or owls in specific areas. FWS also may provide guidance for the use of snares within a certain distance from important | SOPs minimize risks, however a potential for eagle take remains. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Foothold traps<br><br>Alternatives 1, 2, 3, 4, and 5 | Moderate potential for take | 1) Non-target capture<br>2) Human disturbance | 1) Eagles, Raptors and owls<br>2) Eagles | 1) Foothold traps are not a preferred method for capturing feral swine. APHIS primarily uses blind sets for foothold traps or sets traps on routes to bait sites. Baits are typically grain-based, and meat baits are not used. Prior to setting traps, APHIS specialists examine the trail to determine if non-target species are using the trail and usually avoid setting traps on travel routes where there is evidence of extensive use by non-target species. Space is left between trap sets so that animals scavenging on the carcass of a pig caught in one trap would not be at risk of capture from an adjacent trap. Pan tension devices are used to prevent smaller animals from triggering the traps.<br><br>1, 2) Other potential protective measures which may be implemented on a case-by-case basis may include not using traps in habitat near active eagle nests. Minimizing time spent in an area and reducing trap use in certain areas will further reduce impacts to migratory birds and eagles. | No potential for take where states do not use foothold traps. Most states do not use foothold traps to capture feral swine. Local use of foothold traps to capture feral swine could result in take and would need to be addressed in local level NEPA analyses. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Ground shooting | High potential for take | 1) Lead poisoning from lead ammunition (steel or other not a problem)<br>2) Noise | 1) Migratory birds (scavengers, birds of prey)<br>2) Eagles | 1)In some areas, APHIS may avoid using lead shot and bullets where carcasses may be scavenged. Nontoxic ammunition options suitable for feral swine are currently limited based on cost and availability.<br>1)Carcasses shot with lead may be retrieved or made inaccessible to scavenging birds (e.g. California condor and eagles).<br>2)Method use may be avoided where active eagle nests are located, or methods may be avoided during breeding seasons when migratory birds are vulnerable to disturbance. Time can be minimized in an area to further reduce impacts to eagles and migratory birds. | Lead shot or bullet fragments may take scavenging migratory birds and eagles. [Risk assessment conclusions?] |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Capture methods | Cage traps/corral (including use of bait and fencing to surround trap area, if used)<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Non-target capture<br>2) Disturbance<br>3) Structural addition to the landscape | Migratory birds and eagles | 1)When possible, baits are used that do not attract scavengers . Camera devices may be used to monitor and trigger traps when pigs enter traps. Traps are checked frequently according to State/Territorial/Tribal law and APHIS policy. Corral traps have open tops and usually have large mesh wire allowing escape for birds.<br><br>2, 3)Potential effects can be avoided by not locating cage and corral traps where sensitive nesting migratory bird species occur or where eagles may be disturbed. This would consider both trap setup/construction/placement and attracting feral swine to area. Minimizing time spent in an area and removing traps immediately after they are no longer needed can further reduce impacts to migratory birds and eagles. | No take is expected with implementation of SOPs. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Drop nets (including use of bait and fencing to surround trap area, if used)<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Trampling<br>2) Human disturbance<br>3) Structural addition to the landscape | 1) Migratory birds<br>2) Eagles<br>3) Migratory birds and eagles | 1, 2) Drop nets would not be used where ground nesting birds or eagles are located, therefore trampling and disturbance to eagles would be avoided.<br><br>Use of drop nets requires constant supervision by APHIS personnel. Nets are deployed manually by personnel only when target species are present. | No take is expected. |
| Exclosures | Fencing or other barriers<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Bird collisions with wire fencing<br>2) Human disturbance<br>3) Structural addition to the landscape | 1) Migratory birds<br>2) Eagles<br>3) Migratory birds | APHIS is not likely to install exclosures. APHIS may provide technical assistance to landowners for this method; however, the fencing would be installed by the resource manager or landowner, and that individual would be responsible for MBTA and BGEPA compliance. | APHIS would not be expected to take migratory birds or eagles. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| Carcass disposal | Onsite burial Effects will likely depend on location and size of burial site)<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Human disturbance<br>2) Lead poisoning | 1) Migratory birds and eagles<br>2) Eagles, scavenging birds | 1, 2) Burial sites large enough to accommodate several swine would likely be located on pre-disturbed sites such as agricultural operations. This would minimize alteration of vegetation and reduce impacts to migratory birds and eagles.<br><br>APHIS would follow State/Territorial/Tribal and location regulations and guidelines pertaining to the incidental burial of animals. State/Territorial/Tribal guidelines generally offer recommendations for general soil types, burial depth, and distance from ground water to prevent leachates from entering surface or ground water.<br><br>Site selectivity and minimizing time spent in an area would reduce any risk of take of migratory birds or eagles. | No take would be expected. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Leave in Place Alternatives 1, 2, 3, 4, and 5 | Moderate potential for take. | 1) Attract scavengers that cause disturbance or predation<br>2) Lead poisoning | 1) Migratory birds<br>2) Eagles and other scavenging birds | Carcass removals may be scheduled during seasons in locations when ground-nesting birds and their offspring are vulnerable to scavengers that may be attracted by carcasses. Removals also may be scheduled if carcasses contain lead and are near important eagle use areas. Leaving carcasses in place, when possible, will minimize disturbance and time spent in an area and may provide supplementary food source.<br><br>Coordination with land management agencies would identify areas of concern for avoidance. | Take would depend on lead ammunition used and location/presence of scavengers. Adherence to conservation measures would minimize the potential for take. |
| | Landfill<br><br>Alternatives 1, 2, 3, 4, and 5 | None | None | None | Licensed landfills have regulations and monitoring in place to prevent adverse impacts on migratory birds and eagles. | |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Composting (Effects will depend on location and size of site) Alternatives 2, 3, 4, and 5 | Low potential for take | 1) Human disturbance<br>2) | 1, 3, 4) Migratory birds<br>2,3,4) Eagles | APHIS would not establish new composing systems. Existing sites are expected to comply with State /Territorial/Tribal regulations. | No take would be expected. |
| | Donation for human or animal consumption<br><br>Alternatives 1, 2, 3, 4, and 5 | None | None | None | | |
| | Rendering Alternatives 2, 3, 4, and 5 | None | None | None | | |
| | Incineration (Fixed facility)<br><br>Alternatives 2, 3, 4, and 5 | None | None | None | APHIS would likely not employ open-air burning or air curtains as methods for carcass disposal. Any incineration would be through the use of fixed-facility incinerators which are highly controlled. | |
| | Chemical digester<br><br>Alternatives 2, 3, 4, and 5 | None | None | None | | |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| General | Vehicular site access for all activities<br><br>Alternatives 1, 2, 3, 4, and 5 | Low potential for take | 1) Disturbance | 1) Migratory birds and eagles | Vehicles primarily use existing roadways. Coordination with FWS, State/Territorial/Tribal resource agencies, land management agencies and/or landowners identifies areas where listed species may be affected. Nesting areas may be avoided.<br>Ground crews assisting aerial shooting teams generally only use established roads and trails, which minimizes risk of disturbing eagles or encountering nesting migratory birds. Off-road movements are most likely to occur in situations where ground crews are retrieving carcasses of animals. Time in an area should be reduced to minimize impacts to migratory birds and eagle | No take would be expected to occur with observance and implementation of SOPs including |

| **WS Action** | **Sub-actions and Applicable Alternatives** | **Potential for Take (High, Moderate, Low, or None)** | **Type of effect(s)** | **Species type affected** | **Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk** | **Conclusion** |
|---|---|---|---|---|---|---|
| | Foot/horseback access for all activities Alternatives 1, 2, 3, 4, and5 | Low potential for take | 1) Trampling Human disturbance | 1) Migratory birds Eagles | Field observation and coordination with land and resource management agencies would allow for identification of areas where ground nesting birds and eagles could be disturbed. Take would be avoided by identifying and avoiding sensitive areas. | No take is expected. |

| WS Action | Sub-actions and Applicable Alternatives | Potential for Take (High, Moderate, Low, or None) | Type of effect(s) | Species type affected | Typical practices (SOPs and other conservation measures) that may reduce or eliminate risk | Conclusion |
|---|---|---|---|---|---|---|
| | Overall outcome of feral swine removal program | May benefit migratory birds and eagles<br>2) Potential for take of both migratory birds and eagles | 1) Reduced potential for adverse impacts from predation, 2) Reduced potential for destruction of habitat from wallowing and rooting, and<br>3) reduced potential for adverse impacts from disease transmission.<br>4) Take effects discussed above. | 1) Migratory birds<br>2) Migratory birds<br>3)Migratory birds and eagles | Feral swine removals may occur specifically to protect migratory bird species, or may benefit migratory birds and eagles species and critical habitats when removed for other reasons.<br><br>No protective practices needed. | Overall benefit expected, most directly to ground nesting birds or birds which nest in riparian habitats affected by feral swine.<br><br>Unintentional take of some individual migratory birds and/or eagles by some FSDM methods may not be avoidable; however population level effects would not be measurable. See discussions above for take from specific methods. |

# APPENDIX G

# IMPACT ASSESSMENT TOOL FOR PROTECTION OF HISTORIC RESOURCES

This Appendix provides tables summarizing potential risks to resources protected under the National Historic Preservation Act. This table is intended as a blueprint to aid APHIS-WS State, Territory and Tribal level analysis of impacts to resources protected under the act.

| Summary of WS Feral Swine Activities and Potential Effects – NHPA | | | | |
|---|---|---|---|---|
| WS Action | Sub actions and Alternatives | Effect Determination | Type of Effects | Contact SHPO (Y/N) |
| Technical assistance | Alternatives 1, 2, 3, 4 and 5 | NE | None | No |
| Cooperative agreements | Alternatives 1, 2, 3, 4 and 5 | NE | None | No |
| National level outreach expanded, incl. public education and information/assistance with state regulatory mechanisms | Alternatives 2, 3, 4 and 5 | NE | None | No |
| Frightening Devices | Pyrotechnics, other sounds, strobe lights, other visual deterrents | Potential Adverse Effects | Disturbance from brief noise | No –<br><br>Feral swine become quickly habituated to the use of frightening devices. Thus, the use of such devices would likely be minimal due to their |

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| | Alternatives 1, 2, 3, 4 and 5 | | | limited effectiveness.<br><br>Devices would primarily be deployed at airports and to protect agriculture crops/livestock during periods when crops or livestock are particularly vulnerable. These areas are not generally located near historic properties. Method use can be avoided near historic properties. |
| Monitoring to locate/track swine | Judas pig<br><br>Alternatives 1, 2, 3, 4 and 5 | Telemetry collar: NE | None | None |
| | | Capture: effect depends on trap method | See discussions on trapping methods. | |
| | Aerial location of swine<br><br>Alternatives 1, 2, 3, 4 and 5 | Potential Adverse Effects | Minimal and brief noise disturbance | No – effects will be mitigated<br><br>Flight passes are brief and not of sufficient duration or frequency to constitute a chronic disturbance. Sensitive areas can be avoided.<br><br>Effects of ground crews are addressed in section on vehicular site access below. |
| | Tracking dogs<br><br>Alternatives 1, 2, 3, 4 | Potential Adverse Effects | Disturbance via trampling and brief noise | No – effects will be mitigated<br><br>APHIS will not release dogs in areas where they would disturb historic properties unless previously |

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| | and 5 | | | arranged with the property owner.<br><br>In accordance with APHIS policy (APHIS-WS Directive 2.445), all dogs used by APHIS employees must be trained in the skills necessary to perform a specific wildlife damage management task and be controllable at all times. |
| Monitoring for diseases in feral swine | Capture (depends on method used)<br><br>Alternatives 1, 2, 3, 4 and 5 | See effects below | | |
| | Sample collection<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No |
| GonaCon/ Reproduction Inhibitors | Injection | NE | None | No<br><br>There is no known danger associated to humans or wildlife from eating animals that have been vaccinated with GonaCon™. In 2009, the EPA determined there is little likelihood of dietary exposure or impacts to humans who consume meat from a treated doe. As with other vaccines, such as those used with livestock, both the vaccine and the antibodies produced are proteins. Once ingested, |

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| | | | | they are broken down by stomach acids and enzymes. Similar injectable hormone-altering products are used routinely in livestock applications. |
| Killing methods | Aerial shooting<br><br>Alternatives 1, 2, 3, 4 and 5 | Potential Adverse Effects | Disturbance from noise; visual concerns | Yes<br><br>Flight passes are brief and not of sufficient duration or frequency to constitute a chronic disturbance.<br><br>Sensitive areas can be avoided since all work is coordinated with landowners and land management agecneis.  In some areas it may be possible to adjust time of flight (season or time of day) to minimize impacts to visitors of historic properties.<br><br>Effects of ground crews are addressed in section on vehicular site access below.<br><br>With avoidance and  scheduling modifications, this method is not likely to negatively impact historic properties. |
| | Snares<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>Snares would not be placed on historic properties unless specifically requested. |
| | Foothold traps<br><br>Alternatives 1, 2, 3, 4 | NE | None | No<br><br>Foothold traps would not be placed on historic |

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| | and 5 | | | properties unless specifically requested. |
| | Ground shooting<br><br>Alternatives 1, 2, 3, 4 and 5 | Potential Adverse Effects | Disturbance from trampling and noise; visual concerns | No – effects will be mitigated<br><br>Noise from ground shooting is brief and not of sufficient duration or frequency to constitute a chronic disturbance.<br><br>Ground shooting will only take place on historic properties if requested.<br><br>Sensitive areas can be avoided to minimize impacts to visitors of historic properties. |
| | Cage/corral traps (including use of bait and fencing to surround trap area, if used)<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>Where possible, cage and corral traps are set in previously disturbed or cultivated areas.<br><br>Cage/corral traps would not be placed on historic properties unless specifically requested. |
| Capture methods | Drop nets (including use of bait and fencing to surround trap area, if used)<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>Where possible, drop nets are used in previously disturbed or cultivated areas. Drop nets require constant supervision by APHIS personnel.<br><br>Drop nets would not be placed on historic properties unless specifically requested. |

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| | | | | Consideration will be given to the surrounding areas where swine may be attracted too. |
| | Fencing or other barriers<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>APHIS is not likely to install exclosures. However, assistance may be provided to landowners that use this method. These individuals would be responsible for NHPA compliance. |
| Exclosures | Landfill<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No |
| Carcass disposal | Leave in place<br><br>Alternatives 1, 2, 3, 4 and 5 | Potential Adverse Effects | Impact to aesthetic quality; potential for public to view carcasses while at a historic site | No – effects will be mitigated<br><br>Carcass removal could occur near historic properties of concern. |
| | Onsite burial (effects will likely depend on location and size of burial site)<br><br>Alternatives 1, 2, 3, 4 and 5 | Potential Adverse Effects | Ground disturbance | Yes, however, site selectivity should result in no effect.<br><br>Burial sites large enough to accommodate several swine would likely be located on pre-disturbed sites such as agricultural operations.<br><br>Coordination with SHPOs will prevent disturbance |

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| | | | | of historic properties.<br><br>APHIS would follow State/Territorial/Tribal and location regulations and guidelines pertaining to the incidental burial of animals.<br><br>State/Territorial/Tribal guidelines generally offer recommendations for general soil types, burial depth, and distance from ground water to prevent leachates from entering surface or ground water. |
| | Composting (effects will depend on location and size of site)<br><br>Alternatives 2, 3, 4 and 5 | Potential Adverse Effects | Impact to aesthetic quality | No<br><br>APHIS would not establish new compost systems. Existing sites are expected to comply with State /Territorial/Tribal resource agencies. |
| | Donation for human or animal consumption<br><br>(Individual landowners)<br><br>Alternatives 1, 2, 3, 4 | NE | None | No |

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| | and 5 | | | |
| | Rendering<br><br>Alternatives 2, 3, 4 and 5 | NE | None | No |
| | Incineration (fixed facility)<br><br>Alternatives 2, 3, 4 and 5 | NE | None | No<br><br>APHIS would likely not employ open-air burning or air curtains as methods for carcass disposal. Any incineration would be through the use of fixed-facility incinerators which are highly controlled. Most incinerators are fitted with afterburners to reduce emissions. |
| | Chemical digester<br><br>Alternatives 2, 3, 4 and 5 | NE | None | |
| | Vehicular site access for all activities<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>Vehicles primarily use existing roadways. Ground crews assisting aerial shooting teams generally only use established roads and trails, which minimize risk of disturbing historic properties. Off-road movements are most likely to occur in situations where ground crews are retrieving |

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| | | | | carcasses of animals. |
| General | Foot/horseback access for all activities<br><br>Alternatives 1, 2, 3, 4 and 5 | NE | None | No<br><br>Effects not likely under typical operations. Consultations would be initiated if proposed actions may affect historic properties. |
| | Overall outcome of feral swine removal program<br><br>Alternatives 1, 2, 3, 4 and 5 | 1) Beneficial effect<br>Potential Adverse Effects | 1) Reduced potential for adverse impacts from predation, wallowing, and rooting.<br><br>2) Effects discussed above | Feral swine removals may occur specifically to protect historic properties or may benefit properties when swine are removed nearby.<br><br>Mitigation measures will be enacted as discussed above to minimize potential adverse effects. |

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| | | 2) | | |

# APPENDIX H

# Feral Swine Carcass Disposal and Disposition Options - Summary of Advantages, Challenges, and Potential Environmental Effects

This section summarizes the advantages, challenges and environmental effects of feral swine carcass disposition and disposal options. The options were described in Chapters 2 and throughout Chapter 4. Chapter 2 described the disposal options including some of the costs and logistical constraints. The potential environmental effects of the options were evaluated throughout Chapter 4 where they were relevant to individual affected environmental resource issues. The effects of the disposal options would not change substantially among alternatives, except that there may be some variation in the number of carcasses requiring disposal overall, and in the case of the Federal Grant Program Alternative, Alternative 5, APHIS-WS would not be directly involved in disposal practices.

The following disposal methods are discussed in this section:

1. Food Use
2. Composting
3. On-site Burial
4. Landfill Disposal
5. Incineration
6. Chemical and Anaerobic Digesters
7. Rendering
8. Leave On-site

A number of variables must be considered when making local decisions about the best way to manage feral swine carcasses. Carcasses would be disposed of according to federal, state, and local regulations and according to APHIS policies (WS Directives 2.515, 2.210, and 2.510). Other considerations include cost, local availability, logistics, access limitations such as terrain and infrastructure, land uses including public uses, soil types, proximity to water sources, the number of carcasses, the method of capture or kill (specifically whether or not lead shot/bullets or immobilization chemicals were used), potential environmental impacts of the options, resource requirements to mitigate negative environmental effects.

The APHIS National FSDM programmatic EIS does not attempt to make local decisions on the best way to manage carcasses because of the wide range of site specific considerations. In addition, some variable such as local regulations, land use policies, and disposal options can change over time. Therefore, this summary is meant to be used as a guide for APHIS-WS and partner agencies to aid in making local decisions. Local considerations and environmental effects of carcass disposal or disposition would be included in site-specific NEPA documents or other analyses.

## A. Food Use

### 1. Advantages

Where state regulations allow and when the animal has not been chemically immobilized or euthanized, feral swine carcasses may be provided to requesting individual property owners where the animals are captured and killed. These individuals may choose to retain the carcass to use the meat for personal consumption. This is advantageous to the recipient and eliminates disposal costs to the agency.

### 2. Challenges

The Federal Meat Inspection Act requires feral swine to be inspected live, slaughtered under inspection, and processed under inspection to be eligible for donation to charities. Animals euthanized off-site and delivered to USDA-licensed facilities are not eligible for donation. However, provided the animals have not been treated with chemicals that would preclude use as food (e.g., immobilization and euthanasia chemicals) or shot with lead-based ammunition, and if state regulations and permits allow, euthanized swine may be offered to the landowners for personal consumption.

Challenges associated with transport of feral swine and local limitations on the availability of facilities willing and able to process swine limit the utility of this method. However, in some areas (e.g., Texas) mobile inspection and animal processing stations have been developed to meet the needs of the commercial game production industry. It may be possible to adapt these strategies for use with feral swine.

### 3. Environmental Impacts

When landowners prefer to keep a feral swine carcass that was killed on its property, APHIS-WS provides information about food safety and the safe handling of the carcass and proper cooking of the meat to reduce risks. Therefore risks to human safety are minimized by emphasizing precautions for safe handling and consumption. In addition, landowners are advised not to feed pets or other animals uncooked meat or other raw carcass products. However, APHIS WS has no control over the actions of others.

## B. Composting

### 1. Advantages

On-farm composting is a natural process that produces humus, a useful end product. Some livestock producers may already use composting to manage routine livestock disposal. WS may utilize composting operations already in-place by farmers or producers, but would not construct new composting facilities.

#### 2. Challenges

Composting must be managed properly to avoid attracting pest species to the area or causing noxious odors that offend the surrounding community. A carcass composting system requires a carbon source (e.g., sawdust, straw, silage, manure, or leaves), bulking agents (e.g., sludge cake, spent horse bedding, or rotting hay bales), and biofilters (a biofilter is a layer of carbon source and/or bulking agent that enhances microbial activity, deodorizes the gases released at ground level, and prevents access by insects and birds) (NABCC 2004). Composting would only be conducted in coordination with land management agencies and landowners, and in compliance with federal, state, territorial, tribal, county and local regulations and in accordance with APHIS-WS Directive 2.515, and where facilities already exist. APHIS-WS would not create new composing systems.

#### 3. Environmental Impacts

APHIS is not likely to use composting to dispose of feral swine carcasses. Construction of composting sites requires consideration of effects on listed species. No effects on endangered species or critical habitats are expected since the facilities would be pre-existing and the choice to use this option is flexible. If APHIS WS uses composting it would comply with state and local regulations and guidelines for proper procedures. Thus, composing is not anticipated to adversely affect environmental resources including soils or water quality or generate offensive odors.

The potential for carcasses to harbor diseases may be unknown unless the feral swine were specifically targeted for disease monitoring and surveillance. In any case, feral swine that are host to a disease agent would be composted on-site – reducing the possibility for disease transmission off-site, though transmission to other swine prior to death could not be ruled out, thought it would not be exacerbated by FSDM. Thus overall risks from composting carcasses killed on-site may not exceed the status quo as long as carcass numbers are not concentrated.

### C. On-Site Burial

#### 1. Advantages

On-site burial can be economically feasible and minimizes or eliminates transportation needs. Some livestock operations use trench or pit burial for routine livestock carcass management already, thus feral swine carcasses may be added to existing systems if approved by the landowner and compliant with applicable rules for livestock burial.

#### 2. Challenges

Cultural resource laws, endangered species/critical habitat considerations, land uses, climate, soil type and depth, vegetation, and proximity to ground and surface water resources must be considered in selecting new burial sites. New burial sites require coordination with SHPOs, land managers/landowners and tribes to determine if cultural/historic resources may be present. Burial site selection and excavation depth should be planned to avoid water contamination considering depth to ground water and distance to surface waters and wells. Excavation and remediation should conserve topsoil, control erosion and runoff, and allow for revegetation. Heavy excavation equipment may increase the potential for adverse effects.

Local planning must include consultation with state/territorial/tribal wildlife, environmental quality, and/or agriculture officials (e.g. State Veterinarian) to ensure that local guidelines on carcass burial are considered and potential contamination concerns are mitigated.

**3. Environmental Impacts**

APHIS-WS does not use burial for feral swine carcass disposal in most states. Some state regulations require burial or limit various options but include burial. Most burial sites to date have been small and shallow to contain few individual animals. It is conceivable that some property managers may choose to bury larger numbers of feral swine as the number of feral swine killed expands operationally over current program levels. Burial sites can be selected to minimize or avoid potential adverse effects. ESA Section 7 consultations would be conducted for any listed plant species that may be adversely affected or designated critical habitats that may be adversely modified. Preference is given to new burial sites on previously disturbed areas. Cultural/historic resources impacts would be avoided through making siting decisions after coordination with SHPOs, tribal authorities, and land managers.

Nitrogen, chloride, and pathogens may cause soil and water contamination when carcasses are buried on-site. Most sates do not regulate feral swine burial, however states and other local authorities provide guidance for routine livestock burial to protect soil and water quality among other concerns. When feral swine carcasses are disposed of in existing routine livestock burial trenches or pits, cumulative impacts could potentially have higher environmental risks, however those effects are likely to be mitigated by producers following local guidelines for livestock carcass burial which are in place to protect soils and water resources.

The potential for carcasses to harbor diseases may be unknown unless the feral swine were specifically targeted for disease monitoring and surveillance. In any case, feral swine that are host to a disease agent would have died in place and/or may have spread the disease to other swine or other animals if it was not removed in FSDM. Thus overall risks from leaving carcasses on-site may not exceed the status quo as long as carcass numbers are not concentrated.

Burial site remediation should include soil conservation measures to minimize runoff and soil erosion, loss of topsoil, and effects on vegetation.

APHIS-WS' local environmental reviews may be issued to implement decisions made from this EIS and would include local analysis of impacts on soil, vegetation and water quality where on-site burial is a proposed disposal option.

In conclusion, burial is not a widely used disposal option, and where it is used, few individual carcasses are usually involved. This presents a low level risk when compared with the effects of live feral swine and dying in place from natural death over the landscape. Some feral swine carcasses would likely be added to existing routine livestock trench or pit burial sites. Environmental effects would thus be mitigated by the land manager who complies with livestock burial rules. Where more than one sounder is slated for on-site burial of feral swine only, the general lack of regulatory controls over on-site feral swine carcass burial and the soil and water contamination risks from larger groups of carcasses is a concern that should be resolved with local resource experts.

## 4. Landfill Disposal

### 1. Advantages

Some commercial landfills are approved for animal disposal and are strictly regulated by the EPA and local authorities. Environmental risks are mitigated by the landfill operator. Landfill operators are required to collect and treat leachate to protect groundwater, cover waste to protect air quality and reduce scavenging, and implement other measures to protect other environmental resources and public health risks.

### 2. Challenges

Approved landfills that will accept feral swine carcasses may not be widely available, while landfill disposal and associated transportation increase operational costs. Transportation of feral swine carcasses is a potential source of disease transmission risk. Disease related risks from feral swine carcasses are thought to diminish over time, however feral swine carcasses would need to be transported to a landfill at the time of the management action, not allowing time for disease risks to abate.

### 3. Environmental Impacts

Environmental impacts are limited to transportation.

## 5. Incineration

### 1. Advantages

Open burning may be favored over burial when soils are rocky or shallow, or a high water table is present.

**2. Challenges**

Open burning should be avoided (APHIS WS Directive 2.515) due to potential fire hazards except when this method is required by regulations and can be conducted safely. Additionally, open burning requires sufficient combustible materials.

APHIS Directive 2.515 allows for carcasses to be incinerated in approved facilities that comply with federal, state, and local regulations. Availability of incineration facilities approved for large numbers of large animals can be a limitation with regard to feral swine carcass disposal and may not be practical in many areas.

**3. Environmental Impacts and Conclusions**

APHIS WS does not typically use this option, and future use is not likely to increase substantially due to shortage of available facilities, associated costs, transportation requirements, regulatory restrictions, and safety and air quality issues.

## 6. Chemical and Anaerobic Digesters

**1. Advantages**

Chemical digesters create an effluent that is easily disposed or utilized depending on the digesting agent. Anaerobic digesters produce energy (biogas) that may be used as fuel.

**2. Challenges**

Lack of alkaline hydrolysis and anaerobic digestion facilities is a current limitation with regard to feral swine carcass disposal.

**3. Environmental Impacts**

These options have not been assessed in detail since they are not expected to be pursued. However, digesting facilities are regulated by federal and state entities, so the possible use of existing aerobic digestion facilities is not expected to have any negative effect on the environment.

## 7. Rendering

**1. Advantages**

Rendering can generate useful by-products such as animal feed or fertilizer, and is economically feasible if rendering plants are available.

**2. Challenges**

Rendering cannot be used for feral swine that are killed with lead ammunition. Availability of independent rendering plants may be limited. Remote operational locations may preclude this option in many cases.

### 3. Environmental Impacts

Rendering plants are regulated to be environmentally sound. Thus no adverse effects on air quality during processing, or on end product users are expected.

## 8. Leave On-site

### 1. Advantages

Leaving carcasses in place or on-site simulates natural death by allowing carcasses to remain in the ecosystem for scavenging and other natural processes. Leaving carcasses on-site is the lowest cost disposal option. Carcass retrieval is avoided, therefore access challenges, transporting carcasses, additional vehicle use, and disturbance of sensitive ecosystems are avoided. This option is particularly desirable when using aerial shooting in remote areas. Leaving carcasses on-site also minimizes the potential for disease transmission to off-site locations and may be preferred by state and local animal health authorities.

### 2. Challenges

Consideration must be given to the effects of lead ammunition, if used, on scavengers, including eagles and other vulnerable protected species. Decisions on using this option must consider public exposure to visual and odor effects and land use conflicts, and must comply with land owner agreements and federal, state, territorial, tribal, and local laws and regulations regarding carcass disposition. This option may not be desirable with higher levels of human use where exposure is more likely to be offensive and pose other risks to humans or domestic animals.

### 3. Environmental Impacts

Leaving carcasses on-site is currently the most widely practiced carcass management option and can be the most environmentally preferable option with aerial shooting in more remote areas or where ground access is limited. While it may be preferable in many cases, there are important environmental impact considerations and mitigations via SOPs are oftentimes necessary.

Leaving carcasses on-site can attract predators to vulnerable protected species such as ground nesting birds. Measures to avoid or minimize harmful effects include identification of issues and resolutions through ESA consultations, coordination with land managers, and by avoiding sensitive areas altogether or during critical life stages such as breeding, nesting, or birthing seasons. When lead ammunition is used it can pose toxicity risks to scavengers including eagles and vulnerable listed species, such as the California condor. Risks are minimized through coordination with land managers, ESA consultations, SOPs to minimize risk, and using non-toxic ammunition in designated areas such as the range of the California condor and in other areas when readily available, safe, practical and effective. Eagles may be attracted to feral swine carcasses that are taken at trap and snare sites. To reduce risk of an eagle walking onto a trap or into a snare, feral swine carcasses would be left downwind and crosswind of trap or snare sets.

Feral swine carcasses that are left on-site would pose only a very limited disease risk to human health and safety since the putrefication process destroys most disease causing agents. Most disease agents require a live host and fail to survive when their host dies. Although prion diseases are known to be particularly persistent in the environment they are not known to occur in feral swine. Feral swine carcasses left in the field would generally not be left in locations frequented by the general public and would only be left with landowner permission. The potential for the general public to encounter a feral swine carcass would be expected to be extremely remote.

Feral swine carrying the pseudorabies virus (PRV) can present a mortality risk to domestic animals and other non-target mammals if they ingest tissues from a fresh carcass. A decomposing carcass is not likely to pose a risk, thus leaving feral swine on-site presents only a short term risk.

The potential for carcasses to serve as a source of infection may be unknown unless the feral swine were specifically targeted for disease monitoring. In any case, feral swine that are host to a disease agent would have died in place and/or may have spread the disease to other swine or other animals if it was not removed in FSDM. Thus overall risks from leaving carcasses on-site may not exceed the status quo as long as carcass numbers are not concentrated.